EXHIBIT T-4

MASTER SPECIFICATIONS

EXHIBIT T-4 (MASTER SPECIFICATIONS)

1. For the purposes of the Project Agreement, the Master Specifications means, collectively, the following documents:

   (a) the negotiating period design development summary identified in Part A of this Exhibit T-4 Master Specifications (the "**Exhibit T-4 Negotiation Period Summary**"); and

   (b) the PGCPS technical specification documents identified in Part B of this Exhibit T-4 Master Specifications (collectively, the "**Exhibit T-4 PGCPS Master Specification Documents**").

2. In the event of any ambiguities, conflicts or inconsistencies between or among any of the documents comprising the Exhibit T-4 PGCPS Master Specification Documents and the Exhibit T-4 Negotiation Period Summary, the Exhibit T-4 Negotiation Period Summary shall prevail in all matters; and

3. For greater certainty, where any element, sketch, feature or other document or item contained in any part of the Exhibit T-4 PGCPS Master Specification Documents is modified, superseded, qualified, conflicts with or is otherwise amended by the Exhibit T-4 Negotiation Period Summary, the Exhibit T-4 Negotiation Period Summary shall prevail.

PART A

EXHIBIT T-4 NEGOTIATION PERIOD SUMMARY

NEGOTIATED DESIGN SPECIFICATION CHANGES (2020.11.19)

NO.	DESCRIPTION
1	Master Specifications, Section 262414 Generator Quick Connect Switchboard is deleted in its entirety.

PART B

EXHIBIT T-4 PGCPS MASTER SPECIFICATION DOCUMENTS

SECTION 07 0150.19
PREPARATION FOR RE-ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Replacement of existing roofing system in preparation for entire new roofing system.

B. Partial replacement of existing roofing system in preparation for replacement roofing system in designated areas as indicated on drawings.

C. Re-cover of existing roofing system in preparation for entire new roofing system.

D. Removal of existing flashing and counterflashings.

E. Temporary roofing protection.

1.02 RELATED REQUIREMENTS

A. Section 07 5100 - Built-Up Bituminous Roofing.

B. Section 07 5200 - Modified Bituminous Membrane Roofing.

C. Section 07 5300 - Elastomeric Membrane Roofing.

D. Section 07 5400 - Thermoplastic Membrane Roofing.

E. Section 07 5600 - Fluid-Applied Roofing.

F. Section 07 5700 - Coated Foamed Roofing.

G. Section 07 6200 - Sheet Metal Flashing and Trim: Replacement of flashing and counterflashings.

1.03 REFERENCE STANDARDS

A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus 2013.

B. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board 2012.

C. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation 2018.

D. ASTM C728 - Standard Specification for Perlite Thermal Insulation Board 2017a.

E. ASTM C1153 - Standard Practice for Location of Wet Insulation in Roofing Systems Using Infrared Imaging 2010 (Reapproved 2015).

F. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing 2013.

G. ASTM C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel 2017.

H. ASTM D2178/D2178M - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing 2015a.

I. ASTM D312/D312M - Standard Specification for Asphalt Used in Roofing 2016a.

J. ASTM D41/D41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing 2011 (Reapproved 2016).

K. ASTM D4601/D4601M - Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing 2004, with Editorial Revision (2012).

L. PS 1 - Structural Plywood 2009.

M. PS 2 - Performance Standard for Wood-Based Structural-Use Panels 2010.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with affected mechanical and electrical work associated with roof penetrations.

B. Preinstallation Meeting: Convene one week before starting work of this section.

1. Attendees:

a. Architect.

b. Contractor.

c. Owner.

d. Installer.

e. Roofing system manufacturer's field representative.

2. Meeting Agenda: Provide agenda to participants prior to meeting in preparation for discussions on the following:

a. Removal and installation schedule.

b. Necessary preparatory work.

c. Protection before, during, and after roofing system installation.

d. Removal of existing roofing system.

e. Installation of new roofing system.

f. Temporary roofing and daily terminations.

g. Transitions and connection to and with other work.

h. Inspections and testing of installed systems.

C. Schedule work to coincide with commencement of installation of new roofing system.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit for each type of material.

C. Shop Drawings: Indicate size, configuration, and installation details.

D. Preconstruction Test Reports.

E. Materials Removal Company Qualification Statement.

F. Installer's Qualification Statement.

G. Preconstruction Testing Agency Qualification Statement.

1.06 QUALITY ASSURANCE

A. Materials Removal Company Qualifications: Company specializing in performing work of type specified with at least three years of documented experience.

1. Comply with EPA notification regulations prior to start of roofing removal work.

2. Comply with removal and disposal regulations of local authorities having jurisdiction (AHJ).

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

1. When same installer as new roofing system, comply with related requirements of section indicated for new roofing system.

2. Approved by existing roofing system warrantor to work on existing warranted roof system.

C. Preconstruction Testing: Conduct testing by an independent test agency, in accordance with provisions of Section 01 4000 - Quality Requirements.

1. Infrared Roof Moisture Survey: Conduct ground-based, walk-over type survey of roofing system in accordance with ASTM C1153.

a. Conduct survey using non-destructive testing (NDT) procedures.

2. Submit report of roofing survey including thermal images of suspect roof areas and corresponding daytime photos of these same areas.

3. Provide required testing to locate hazardous materials, such as asbestos, by licensed agency as required for project location.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

1.08 FIELD CONDITIONS

A. Existing Roofing System: Built-up asphalt roofing.

B. Do not remove existing roofing membrane when weather conditions threaten the integrity of building contents or intended continued occupancy.

C. Maintain continuous temporary protection prior to and during installation of new roofing system.

D. Provide notice at least three days before starting activities that will affect normal building operations.

E. Verify that occupants have been evacuated from building areas when work on structurally impaired roof decking is scheduled to begin.

F. Owner will not occupy building areas directly below re-roofing area.

1. Provide Owner with at least 48 hours written notice of roofing activities that may affect their operations and to allow them to prepare for upcoming activities as necessary.

2. Maintain access of Owner's personnel to corridors, existing walkways, and adjacent buildings.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Existing Warranties: Perform this work using methods and materials that will maintain existing roof system warranties.

1. Notify existing roof system warrantor prior to starting this work and obtain written instructions for procedures necessary to maintain this existing warranty.

2. Upon completion of this work, notify warrantor of reroofing completion and obtain documentation to verify that existing roofing system has been inspected and warranty is still in effect.

a. Submit documentation upon project closeout.

PART 2 PRODUCTS

2.01 COMPONENTS

A. Refer to following sections for additional information on components relating to this work:

1. Partial removal of existing roofing system in preparation for new roofing system in designated areas as indicated on drawings, refer to Section 07 5100.

2. Remove existing flashing and counterflashings in preparation for replacement of these materials as part of this work, refer to Section 07 6200 for material requirements.

2.02 MATERIALS

A. Patching Materials: Provide necessary materials in accordance with requirements of existing roofing system.

B. Temporary Roofing Protection Materials:

1. Contractor's responsibility to select appropriate materials for temporary protection of roofing areas as determined necessary for this work.

2. XPS Sheathing: Extruded Polystyrene (XPS) board insulation, ASTM C578.

C. Roofing Recover Materials:

D. Glass Mat Gypsum Substrate: ASTM C1177/C1177M, Type X (special fire-resistant) and moisture resistant.

1. Board Size: 4 feet by 8 feet (1219 mm by 2438 mm).

2. Board Thickness: 1/2 inch (12.7 mm).

3. Board Edges: Square.

4. Fiber-Reinforced Gypsum Roof Board Panels: ASTM C1278/C1278M, water-resistant.

a. Board Size: 4 feet by 8 feet (1219 mm by 2438 mm).

b. Board Thickness: 1/2 inch (12.7 mm).

c. Board Edges: Square.

5. Fiber Insulation Board: ASTM C208, Type II, Grade 2 cellulosic fiber insulating board, 1-1/2 inch (38 mm) thick.

a. Board Size: 4 feet by 8 feet (1219 mm by 2438 mm).

b. Board Edges: Square.

6. Perlite Recover Board: ASTM C728, Type 2 perlite thermal insulation board.

a. Compressive Strength: 45 psi (310 kPa), minimum, at 10 percent deformation.

b. Board Size: 4 feet by 8 feet (1219 mm by 2438 mm).

c. Board Thickness: 1/2 inch (12.7 mm).

d. Thermal Resistance, R-value (RSI-value): 1.3 (0.23) at 75 degrees F (24 degrees C) mean temperature using ASTM C177 test method.

2.03 ACCESSORIES

A. Fasteners: Type and size as required and compatible with existing and new roofing system to resist local wind uplift.

B. Sheathing Paper: Red rosin paper type, at least 3 lbs per 100 sq ft (141 grams per sq m).

C. Base Sheet: Non-perforated, asphalt-coated glass fiber base sheet, Type II in accordance with ASTM D4601/D4601M.

D. Glass Fiber Felt: Asphalt-impregnated, glass fiber felt, Type IV in accordance with ASTM D2178/D2178M.

E. Asphalt Primer: Apply to concrete decking in preparation for temporary roofing, Type II in accordance with ASTM D41/D41M.

F. Roofing Asphalt: Type III or Type IV, in accordance with ASTM D312/D312M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing roof surface has been cleared of materials being removed from existing roofing system and ready for next phase of work as required.

3.02 PREPARATION

A. Sweep roof surface clean of loose matter.

B. Remove loose refuse and dispose of properly off-site.

3.03 MATERIAL REMOVAL

A. Remove only existing roofing materials that can be replaced with new materials the same day.

B. Remove metal counter flashings.

C. Scrape roofing gravel from membrane surface without causing serious damage to membrane felts.

D. Remove damaged portions of roofing membrane, perimeter base flashings, flashings around roof protrusions, pitch pans and pockets.

E. Cut and lay flat any membrane blisters.

F. Remove damaged insulation and fasteners, cant strips, blocking.

G. Remove vapor retarder.

H. Repair existing wood deck surface to provide smooth working surface for new roof system.

3.04 INSTALLATION

A. Coordinate scope of this work with requirements for installation of new roofing system, refer to Section 07 5100 for additional requirements.

3.05 FIELD QUALITY CONTROL

A. Independent agency inspection and testing will be provided under provisions of Section 01 4000.

B. Testing will identify the condition of existing materials and their reuse, repair or removal.

C. Test Reports: Indicate existing insulation moisture content and existing bitumen quality.

3.06 PROTECTION

A. Provide protection of existing roofing system that is not having work performed on it.

B. Provide temporary protective sheeting over uncovered deck surfaces.

C. Turn sheeting up and over parapets and curbing. Retain sheeting in position with weights.

D. Provide for surface drainage from sheeting to existing drainage facilities.

E. Do not permit traffic over unprotected or repaired deck surface.

F. Install recover board over existing membrane.

3.07 SCHEDULES

A. Entire Roofing Area: Remove existing roofing gravel, perimeter flashings, base flashings, counter flashings, vent stack flashings, roofing membrane, insulation and vapor retarder.

B. Remove roof mounted mechanical equipment and electrical equipment.

END OF SECTION

SECTION 07 0150.61
ROOF RE-COATING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Field applied, heat reflective and emissive coatings for existing metal panel and concrete or clay tile roofs.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 09 9113 - Exterior Painting.

1.03 REFERENCE STANDARDS

A. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus 2018.

B. ASTM D522/D522M - Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings 2017.

C. ASTM D714 - Standard Test Method for Evaluating Degree of Blistering of Paints 2002 (Reapproved 2009).

D. ASTM D4587 - Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings 2011.

E. ASTM D4803 - Standard Test Method for Predicting Heat Buildup in PVC Building Products 2018.

F. ASTM D6904 - Standard Practice for Resistance to Wind-Driven Rain for Exterior Coatings Applied on Masonry 2003 (Reapproved 2013).

G. SSPC-SP 2 - Hand Tool Cleaning 1982, with Editorial Revision (2004).

H. SSPC-SP 3 - Power Tool Cleaning 1982, with Editorial Revision (2004).

I. SSPC-SP 6 - Commercial Blast Cleaning 2007.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating coating materials .

C. Samples: Submit two samples illustrating colors available for selection.

1.05 QUALITY ASSURANCE

A. Maintain one copy of each referenced document that applies to application on site.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with at least three years documented experience.

1.06 FIELD CONDITIONS

A. Do not install materials when temperature is below 45 degrees F (7 degrees C) or above 100 degrees F (38 degrees C).

B. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coatings.

C. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

D. Restrict traffic from area where coating is being applied or is curing.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for bond to substrate.

PART 2 PRODUCTS

2.01 ROOF RE-COATINGS

A. Water Based Heat Reflective Coating System for Metal Roofs: Water based, three coat system consisting of manufacturer's metal primer, bonding primer, and polyvinylidene fluoride and acrylic solar reflective color finish coat.

1. Stated by manufacturer as suitable for metal surfaces.
2. Dry Film Thickness: 6 to 8 mils (0.152 to 0.203 mm), minimum.
3. Accelerated Weathering: Pass, when tested according to ASTM D4587 for 3000 hours.
4. Salt Spray Resistance: Pass, when tested according to ASTM B117 for 500 hours.
    a. Rust: 9.
    b. Scribe Creep: 0.007 inch (2 mm).
5. Flexibility: Pass, when tested according to ASTM D522/D522M with 1/8 inch (3.17 mm) mandrel.
6. Blistering Resistance: Pass, when tested according to ASTM D714 for 100 hours.
7. Wind Driven Rain Resistance: Pass, when tested according to ASTM D6904 at 98 miles per hour (158 km/h) for 24 hours.
8. Surface Temperature Reduction Based on Solar Reflectance: ASTM D4803 modified; estimated increase in solar reflectance and emissivity when compared to control sample of conventional acrylic paint.
9. Color: To be selected by Architect from manufacturer's standard range.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.

3.02 PREPARATION

A. Clean surfaces of loose foreign matter.

B. Remove substances that would bleed through finished coatings.

C. Remove mildew, dirt, grease, oil, chalk and other contaminants that would interfere with the adhesion and bonding of the coating.

D. Existing Painted and Sealed Surfaces:

1. Strip existing paint and coatings from surface.

E. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent.

F. Ferrous Metal:

1. Solvent clean.

2. Remove loose rust, loose mill scale, and other foreign substances using hand tools according to SSPC-SP 2, power tools according to SSPC-SP 3 or blast cleaning according to SSPC-SP 6 or SSPC-SP 7.

G. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.

3.03 PRIMING

A. Apply primer to all surfaces. Apply in accordance with coating manufacturer's written instructions.

3.04 COATING APPLICATION

A. Apply coatings in accordance with manufacturer's instructions, to thicknesses specified.

B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Clean surfaces immediately of overspray, splatter, and excess material.

C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.06 PROTECTION

A. Protect finished work from damage.

END OF SECTION

SECTION 07 0553
FIRE AND SMOKE ASSEMBLY IDENTIFICATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Identification markings for fire and smoke rated partitions, and fire rated walls.

1.02 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Paint finish.

1.03 REFERENCE STANDARDS

A. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of marking, indicating font, foreground and background colors, wording, and overall dimensions.

C. Schedule: Completely define scope of proposed marking. Indicate location of affected walls and partitions, and number of markings.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.06 FIELD CONDITIONS

A. Do not install adhered markings when ambient temperature is lower than recommended by label or sign manufacturer.

B. Do not install painted markings when ambient temperature is lower than recommended by coating manufacturer.

PART 2 PRODUCTS

2.01 FIRE AND SMOKE ASSEMBLY IDENTIFICATION

A. Regulatory Requirements: Comply with "Marking and Identification" requirements of "Fire-Resistance Ratings and Fire Tests" chapter of ICC (IBC).

B. Applied Fire and Smoke Assembly Identification: Identification markings applied to partition with paint and a code compliant stencil. See Section 09 9123 for products.

C. Languages: Provide all markings in English.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 PREPARATION

A. See Section 09 9123 for substrate preparation for painted markings.

3.03 INSTALLATION

A. Locate markings as required by ICC (IBC).

B. Install neatly, with horizontal edges level.

C. Protect from damage until Substantial Completion; repair or replace damaged markings.

END OF SECTION

SECTION 07 1113
BITUMINOUS DAMPPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Bituminous dampproofing.

B. Protection boards.

C. Drainage panels.

1.02 RELATED REQUIREMENTS

A. Section 07 2100 - Thermal Insulation: Rigid insulation board used as protection board.

B. Section 31 2323 - Fill.

C. Section 33 4100 - Subdrainage.

1.03 REFERENCE STANDARDS

A. ASTM D41/D41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing 2011 (Reapproved 2016).

B. ASTM D43/D43M - Standard Specification for Coal Tar Primer Used in Roofing, Dampproofing, and Waterproofing 2000 (Reapproved 2012).

C. ASTM D449/D449M - Standard Specification for Asphalt Used in Dampproofing and Waterproofing 2003 (Reapproved 2014).

D. ASTM D450/D450M - Standard Specification for Coal-Tar Pitch Used in Roofing, Dampproofing, and Waterproofing 2007 (Reapproved 2013).

E. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal 1997 (Reapproved 2018).

F. ASTM D1227 - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing 2013.

G. ASTM D4479/D4479M - Standard Specification for Asphalt Roof Coatings - Asbestos-Free 2007, with Editorial Revision (2012).

H. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free 2007, with Editorial Revision (2012).

I. ASTM D5643/D5643M - Standard Specification for Coal Tar Roof Cement, Asbestos Free 2006, with Editorial Revision (2012).

J. NRCA (WM) - The NRCA Waterproofing Manual 2005.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide properties of primer, bitumen, and mastics.

C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with at least three years of documented experience.

1.06 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F (5 degrees C) for 24 hours before and during application until dampproofing has cured.

PART 2 PRODUCTS

2.01 BITUMINOUS DAMPPROOFING

A. Bituminous Dampproofing: Cold-applied, spray-grade; asphalt base, volatile petroleum solvents, and other content, suitable for application by spray, brush, roller, or squeegee; asbestos-free; suitable for application on vertical and horizontal surfaces.

1. Composition: ASTM D4479/D4479M Type I, minimum, asbestos free.
2. VOC Content: Not more than permitted by local, State, and federal regulations.
3. Applied Thickness: 1/16 inch (1.5 mm), minimum, wet film.

B. Primers, Mastics, and Related Materials: Type as recommended by dampproofing manufacturer.

2.02 BITUMEN MATERIALS

A. Hot Asphaltic Type:

1. Bitumen: ASTM D449/D449M, Type I, asphalt.
2. Primer: ASTM D41/D41M, compatible with substrate.
3. Sealing Mastic: Asphalt roof cement, ASTM D4586/D4586M, Type I, asbestos-free.

B. Coal Tar Type:

1. Bitumen: ASTM D450/D450M, Type II, coal tar pitch.
2. Primer: ASTM D43/D43M, coal tar type.
3. Sealing Mastic: ASTM D5643/D5643M, coal tar roof cement, asbestos-free.

2.03 ACCESSORIES

A. Drainage Panel: 1/4 inch (6 mm) thick formed plastic, hollowed sandwich.

B. Protection Board: Rigid insulation specified in Section 07 2100.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions are acceptable prior to starting this work.

B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.

C. Verify that items penetrating surfaces to receive dampproofing are securely installed.

3.02 PREPARATION

A. Protect adjacent surfaces not designated to receive dampproofing.

B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.

C. Do not apply dampproofing to surfaces unacceptable to manufacturer.

D. Apply mastic to seal penetrations, small cracks, or minor honeycombs in substrate.

3.03 APPLICATION

A. Foundation Walls: Apply two coats of asphalt dampproofing.

B. Foundation Walls: Patch disturbed areas of existing dampproofing with two additional coats of dampproofing of the same generic type.

C. Perform this work in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.

D. Prime surfaces in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.

E. Prime surfaces at a rate approved by manufacturer for application indicated, and allow primer to dry thoroughly.

F. Apply bitumen with roller or by Spray Applcation or with mop.

G. Apply bitumen at a temperature limited by equiviscous temperature (EVT) plus or minus 25 degrees F (14 degrees C); do not exceed finish blowing temperature for four hours.

H. Apply bitumen in one coat, continuous and uniform, at a rate of 25 sq ft/gal (0.6 sq m/L) per coat.

I. Apply from 2 inches (50 mm) below finish grade elevation down to top of footings.

J. Seal items watertight with mastic, that project through dampproofing surface.

K. Place drainage panel directly over dampproofing, butt joints, place to encourage drainage downward.

L. Place protection board directly over dampproofing, butt joints, and adhere to tacky dampproofing.

M. Place protection board over drainage panel, butt joints, and adhere with mastic.

N. Scribe and cut boards around projections, penetrations, and interruptions.

END OF SECTION

SECTION 07 1200
BUILT-UP BITUMINOUS WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hot applied asphaltic waterproofing.

B. Cold applied asphaltic waterproofing.

C. Hot applied coal tar waterproofing.

D. Cant strips.

E. Drainage panels.

F. Protective cover.

1.02 RELATED REQUIREMENTS

A. Section 07 2100 - Thermal Insulation: Protection board.

B. Section 22 1006 - Plumbing Piping Specialties: Roof drain and plumbing vent flashing flanges.

1.03 REFERENCE STANDARDS

A. ASTM D41/D41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing 2011 (Reapproved 2016).

B. ASTM D173/D173M - Standard Specification for Bitumen-Saturated Cotton Fabrics Used in Roofing and Waterproofing 2003 (Reapproved 2018).

C. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing 2017.

D. ASTM D227/D227M - Standard Specification for Coal-Tar-Saturated Organic Felt Used in Roofing and Waterproofing 2003 (Reapproved 2018).

E. ASTM D449/D449M - Standard Specification for Asphalt Used in Dampproofing and Waterproofing 2003 (Reapproved 2014).

F. ASTM D1668/D1668M - Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing 1997a (Reapproved 2014).

G. ASTM D2178/D2178M - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing 2015a.

H. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free 2007, with Editorial Revision (2012).

I. NRCA (WM) - The NRCA Waterproofing Manual 2005.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide properties of primer, bitumen, mastics, and characteristics of reinforcement fabric.

C. Shop Drawings: Indicate flashings, control joints and expansion joints, sealing at openings, projections, penetrations and reglets, and waterproofing of holes, slots and sleeves.

D. Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner 's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

1.06 MOCK-UP

A. Construct mock-up 100 sq ft (10 sq m) of horizontal and vertical waterproofed panel; to represent finished work including internal and external corners, sealing, drainage panel, base flashings, control joints, expansion joints and protective cover.

1.07 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F (5 degrees C) for 24 hours before and during application until membrane has cured.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Contractor shall correct defective work within a five year period after Date of Substantial Completion; remove and replace materials concealing waterproofing at no extra cost to Owner.

C. Provide five year manufacturer warranty against failure of waterproofing to resist penetration of water, except where such failures are the result of structural failures of building.

1. Hairline cracking of concrete due to temperature change or concrete shrinkage is not considered a structural failure.

1.09 DELIVERY AND STORAGE

A. Materials Packaging

PART 2 PRODUCTS

2.01 PRODUCT SUSTAINABILITY CRITERIA

Where allowed by performance criteria:

1. Deliver materials in bundles, rolls, and sealed containers in accordance

B. Reduce Volatile Organic Compounds (VOC) Contents

Provide products with reduced VOC content and provide certificates of

compliance in accordance with Section 01 33 29 SUSTAINABILITY REPORTING

paragraph REDUCE VOLATILE ORGANIC COMPOUNDS.

C. Recycled Content

Provide products with recycled content and provide certificates of

compliance in accordance with Section 01 33 29 SUSTAINABILITY REPORTING

paragraph RECYCLED CONTENT.

2.02 BITUMEN

NOTE: Type I is suitable for use below grade under uniformly moderate temperature conditions (foundations, tunnels, and subways); Type II is suitable for use above grade where not exposed to temperatures exceeding 50 degrees C 122 degrees F (railroad bridges, culverts, retaining walls, tanks, dams, conduits, and spray decks); Type III is suitable for use above grade on vertical surfaces exposed to direct sunlight or temperatures above 50 degrees C 122 degrees F.

Asphalt; ASTM D449/D449M, Type I, II or III

1. with manufacturer's printed handling instructions and bearing
2. manufacturer's original labels. Material labels indicate dates for use or
3. shelf life; remove outdated material, damaged, and deteriorated material
4. from the jobsite. Keep materials wrapped and separated from off-gassing
5. materials (such as drying paints and adhesives). Do not use materials that
6. have visible moisture or biological growth.

B. Materials Storage

1. Asphalt
2. Protect asphalt from freezing. Store asphalt in a weathertight enclosure,
3. free from contact with soil. Store and maintain at not less than 10
4. degrees C 50 degrees F for at least 24 hours before use.

C. Reinforcement Fabrics

1. Handle and store reinforcement fabrics in accordance with manufacturer's
2. printed instructions. Protect fabrics from moisture damage and absorption
3. in a weathertight enclosure or off the ground on pallets, and covered on
4. top and all sides with breathable-type canvas tarpaulins. Plastic sheets
5. cause condensation buildup therefore do not use them to cover waterproofing
6. materials.

D. Bulk Liquid Asphalt

NOTE: Bulk liquid asphalt may be included as a Contractor's option when the project is constructed within 160 kilometers 100 miles of a bulk liquid asphalt manufacturer's plant.

Deliver bulk liquid asphalt in fully insulated, heated transport tanker vehicles with circulating pump devices. Maintain the temperature of the liquid asphalt between 204 and 232 degrees C 400 and 450 degrees F during storage, provided the transport and storage time does not exceed 12 hours. If the transport and storage time exceeds 12 hours, lower the temperature to between 150 and 165 degrees C 300 and 325 degrees F at the time the 12 hours are exceeded. Use liquid asphalt within 36 hours after loading in the transport tanker. Provide bulk liquid asphalt certified laboratory reports for results of tests performed on asphalt delivered to the construction site by bulk liquid asphalt tankers.

E. Asphalt Shipment Records

Obtain from the bulk liquid asphalt manufacturer a certified shipping statement for each asphalt shipment. Following completion of the

waterproofing installation, submit certificates to the Contracting Officer for verification and recordkeeping. Indicate the following:

F. Manufacturer's name

G. Specification identification of asphalt

H. Quantity of asphalt

I. Documentation of transport tanker having been empty and free of foreign and incompatible materials at the time of loading

J. Date, time, and temperature of asphalt at time of loading

K.]1.6 Flame Heated Equipment

L. Fire Protection

Locate melt kettles no closer than 8 meters 25 feet from buildings or combustible materials. Provide and maintain two approved 4-A:40-B:C fire extinguishers within 8 meters 25 feet of each operating kettle. Fire extinguishers, operations and locations must comply with NFPA 1 Section Tar Kettles. Equip asphalt (tar) kettles with tight fitting lids.

M. Operational Requirements

Equip kettles with automatic thermostatic control capable of maintaining asphalt temperature. Calibrate and maintain controls in working order for the duration of the work. Equip kettles with means of agitation and ensure they are operating as necessary to produce a controlled uniform temperature throughout kettle contents to prevent spot heating. Do not heat contents above flash point. Do not place flame heated equipment on the roof.

A. Drippage of Bitumen

Seal joints in and at edges as necessary to prevent drippage of asphalt into the building or onto adjacent surface

2.03 MANUFACTURERS

2.04 WATERPROOFING APPLICATIONS

A. Foundation Walls, Basement Walls, Back side of retaining walls : Three plies of hot asphaltic OR Cold asphalitc OR Coal tar waterproofing, glass fiber reinforcing fabric.

2.05 HOT ASPHALTIC MATERIALS

A. Asphalt: ASTM D449/D449M, Type I.

B. Asphalt Primer: ASTM D41/D41M, compatible with substrate.

C. Sealing Mastic: Asphalt roof cement, ASTM D4586/D4586M, Type I, asbestos free.

D. Reinforcing Fabric: Cotton, ASTM D173/D173M, woven, 10 oz/sq yd (340 g/sq m) average net mass of asphalt saturated fabric.

E. Reinforcing Fabric: ASTM D226/D226M Type I ("No. 15"), asphalt saturated felt.

2.06 COAL TAR MATERIALS

A. Coal Tar: ASTM D450/D450M, Type II.

B. Coal Tar Primer: ASTM D43/D43M.

C. Coal Tar Sealing Mastic: ASTM D5643/D5643M, coal tar roof cement, asbestos free.

D. Reinforcing Fabric: Glass fiber, ASTM D1668/D1668M Type II, woven, coal tar saturated.

2.07 COLD ASPHALTIC MATERIALS

A. Asphalt Emulsion: Complying with ASTM D3747.

B. Reinforcing Fabric: Glass fiber, ASTM D1668/D1668M, Type I, woven, asphalt treated.

2.08 ACCESSORIES

A. Protection Board: Rigid insulation specified in Section 07 2100.

B. Drainage Panel: 1/4 inch (6.4 mm) thick formed plastic, and embossed with cover sheet.

C. Cant Strips: Premolded composition material.

D. Flexible Flashings: Formed plastic, butyl.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify substrate surfaces are durable and free of matter detrimental to adhesion or application of waterproofing system.

B. Verify that items that penetrate surfaces to receive waterproofing are securely installed.

3.02 PREPARATION

A. Protect adjacent surfaces not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions.

C. Do not apply waterproofing to surfaces unacceptable to manufacturer.

D. Apply mastic to seal penetrations, small cracks, or minor honeycomb in substrate.

3.03 WATERPROOFING INSTALLATION

A. Install waterproofing in compliance with NRCA (WM) and applicable requirements.

B. Prime surfaces at a rate approved by manufacturer for application indicated, and allow primer to dry thoroughly.

C. Install cant strips at inside corners.

D. Apply moppings of bitumen and embed reinforcement in accordance with manufacturer's instructions.

E. Apply hot bitumen at a temperature limited by equiviscous temperature (EVT) plus or minus 25 degrees F (14 degrees C); do not exceed finish blowing temperature for four hours.

F. Roll or press reinforcing fabric firmly into bitumen eliminating wrinkles, air pockets, or disruptions of continuity. Lap edges and ends . Weather lap sheet materials.

G. Apply two plies of reinforcing fabric at corners, intersections, angles, and over joints.

H. Apply two plies of reinforcing fabric diagonal to inside corner interruptions to membrane.

I. Extend membrane over cants and up intersecting surfaces at membrane perimeter minimum 6 inches (150 mm) above horizontal surface for first ply at subsequent plies laid in shingle fashion.

J. Extend membrane and flexible flashing into drain clamp flange, apply adequate coating of mastic to assure clamp ring seal. Coordinate with drain installation, refer to Section 22 1006.

K. Terminate top edge of membrane and flexible flashing under counter flashings, seal with mastic. Coordinate with metal flashing installation.

L. Continue reinforced membrane over control joints in accordance with reinforcement manufacturer's instructions.

M. Apply coating to fully conceal reinforcement.

N. Seal protrusions to and penetrations through membrane with multiple plies of reinforcement. Seal watertight.

3.04 PROTECTION BOARD AND DRAINAGE PANEL INSTALLATION

A. Place drainage panel directly against membrane; butt joints; position to direct drainage downward.

B. Place protection board directly against drainage panel; butt joints.

C. Adhere protection board and drainage panel to substrate with mastic, and scribe and cut boards around projections, penetrations, and interruptions.

3.05 FIELD QUALITY CONTROL

A. Provide independent inspection agency services under provisions of Section 01 4000 - Quality Requirements.

B. Upon completion of horizontal membrane installation, dam installation area in preparation for flood testing.

C. If leaking is found, remove water, repair leaking areas with new waterproofing materials as directed by Architect ; repeat flood test. Repair any damage to building caused by leaking.

D. When area is proven watertight, drain water and remove dam.

3.06 PROTECTION

A. Do not permit traffic over unprotected or uncovered membrane.

B. Protect membrane and board from damage.

END OF SECTION

SECTION 07 1300
SHEET WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sheet membrane waterproofing.

B. ccessories.

C. Drainage panels.

1.02 REFERENCE STANDARDS

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers- Tension.

B. ASTM D570 - Standard Test Method for Water Absorption of Plastics.

C. ASTM E96/E96M - Standard Test Methods For Water Vapor Transmission of Materials.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for membrane.

C. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.

D. Certificate: Certify that products meet or exceed specified requirements.

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Membrane Manufacturer Qualifications: Company specializing in waterproofing sheet membranes with three years experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years experience.

1.05 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application and until liquid or mastic accessories have cured.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Contractor shall correct defective Work within a five year period after Date of Substantial Completion; remove and replace materials concealing waterproofing at no extra cost to Owner.

C. Provide five year manufacturer warranty for waterproofing failing to resist penetration of water, except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Carlisle Coatings & Waterproofing Inc.; Product CCW MiraDRI 860/861.

B. Other Acceptable Laminated Composite Manufacturers:

1. Grace Construction Products; Product Bituthene 3000: www.na.graceconstruction.com.

2. Henry Company; Blueskin WP 200.
3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 APPLICATIONS

A. Waterproof for building surfaces:

1. Exterior face of foundation/building walls where finished grade is above finished floor elevation; waterproofing installed from top of footing to finished grade elevation.
2. Concealed vertical face of separation of stepped floor elevations.

2.03 MEMBRANE MATERIALS

A. Composite Laminate Membrane: Comprised of 56 mils thickness of rubberized asphalt and a 4 mils thickness of polyethylene film with release liner on adhesive-side; 60 mils total thickness.

1. Tensile Strength: 325 psi, measured in accordance with ASTM D 412.
2. Water Absorption: 231 percent increase in weight, maximum, measured in accordance with ASTM D 570, 24 hour immersion.
3. Water Vapor Permeability: 0.05 perm inch, measured in accordance with ASTM E 96/E 96M.

B. Seaming Materials: As recommended by membrane manufacturer.

C. Membrane Sealant: As recommended by membrane manufacturer.

D. Termination Bars: Aluminum; compatible with membrane and adhesives.

2.04 ACCESSORIES

A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Manufactured composite subsurface drainage panels consisting of a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 sieve laminated to one side with a polymeric film bonded to the other side of a studded, nonbiodegradable, molded-plastic-sheet drainage core, with a vertical flow rate of 9 to 15 gpm per ft.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.

C. Verify that items that penetrate surfaces to receive waterproofing are securely installed.

3.02 PREPARATION

A. Protect adjacent surfaces not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions. Vacuum substrate clean.

C. Do not apply waterproofing to surfaces unacceptable to membrane manufacturer.

D. Seal cracks and joints with sealant using depth to width ratio as recommended by sealant manufacturer.

E. Surfaces for Adhesive Bonding: Apply surface conditioner at a rate recommended by manufacturer. Protect conditioner from rain or frost until dry.

3.03 INSTALLATION - MEMBRANE

A. Install membrane waterproofing in accordance with manufacturer's instructions.

B. Roll out membrane. Minimize wrinkles and bubbles.

C. Self-Adhering Membrane: Remove release paper layer. Roll out on substrate with a mechanical roller to encourage full contact bond.

D. Overlap edges and ends and seal by method recommended by manufacturer, minimum 3 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.

E. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.

F. Weather lap joints on sloped substrate in direction of drainage. Seal joints and seams.

G. Install flexible flashings. Seal items penetrating through membrane with flexible flashings. Seal watertight to membrane.

H. Seal membrane and flashings to adjoining surfaces. Install termination bar at all edges. Install counterflashing over all exposed edges.

3.04 INSTALLATION - DRAINAGE PANEL

A. Place drainage panel directly against membrane, butt joints, place to encourage drainage downward. Scribe and cut boards around projections, penetrations, and interruptions.

END OF SECTION

SECTION 07 1400
FLUID-APPLIED WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fluid-Applied Waterproofing:

1. Hot-applied rubberized asphalt waterproofing.
2. Cold-applied rubberized asphalt waterproofing.
3. Polyurethane waterproofing.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete substrate.

B. Section 03 4100 - Precast Structural Concrete: Grouting joints of precast concrete deck surfaces.

C. Section 04 2000 - Unit Masonry: Masonry joints prepared to receive flashings.

D. Section 07 2100 - Thermal Insulation: Insulation used for protective cover.

E. Section 07 5050 - Vegetated Roof Components: Protection, drainage, root barriers, soil, plants, and other vegetated roof components installed above waterproofing.

F. Section 07 6200 - Sheet Metal Flashing and Trim: Metal parapet covers, copings and counterflashings.

G. Section 07 9200 - Joint Sealants: Sealing moving joints in waterproofed surfaces that are not part of work in this section.

H. Section 22 1006 - Plumbing Piping Specialties: Roof drain and plumbing vent flashing flanges.

I. Section 31 2323 - Fill.

1.03 REFERENCE STANDARDS

A. ASTM C836/C836M - Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course 2015.

B. ASTM C1306/C1306M - Standard Test Method for Hydrostatic Pressure Resistance of a Liquid-Applied Waterproofing Membrane 2008, with Editorial Revision (2016).

C. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension 2016.

D. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact 2014.

E. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness 2015e1.

F. ASTM D4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers 2017.

G. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.

H. ASTM E154/E154M - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover 2008a, with Editorial Revision (2013).

I. ICC-ES AC29 - Acceptance Criteria for Cold, Liquid-Applied, Below-Grade, Exterior Dampproofing and Waterproofing Materials 2011, with Editorial Revision (2014).

J. NRCA (WM) - The NRCA Waterproofing Manual 2005.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for membrane, surface conditioner, flexible flashings, joint cover sheet and joint and crack sealants.

C. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.

D. Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention and acceptable installation temperatures.

F. Warranty:

1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

2. Submit installer's certification that installation complies with warranty conditions for the waterproofing membrane.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

C. Single Source Responsibility for Vegetated Roof Assemblies Over Waterproofing: Provide and install products from single source.

1.06 MOCK-UP

A. Construct mock-up consisting of 100 sq ft (10 sq m) of horizontal waterproofed panel; to represent finished work including internal and external corners, drainage panel, base flashings, control joints, expansion joints, counterflashings and protective cover.

B. Mock-up may remain as part of this Work.

1.07 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F (5 degrees C) for 24 hours before and during application and until cured.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Contractor shall correct defective Work within a five year period after Date of Substantial Completion; remove and replace materials concealing waterproofing at no cost to Owner .

C. Provide five year manufacturer warranty for waterproofing failing to resist penetration of water, except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.

D. Vegetated Roof Assemblies Over Waterproofing: Provide manufacturer's twenty year, single-source "full system" warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hot-Applied Rubberized Asphalt Waterproofing:

1. American Hydrotech, Inc: www.hydrotechusa.com/#sle.
2. AVM Industries, Inc; Aussie Membrane 570: www.avmindustries.com/#sle.
3. Hydro-Gard; Hydro-Tuff: www.hydro-gard.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Cold-Applied Rubberized Asphalt Waterproofing:

1. AVM Industries, Inc; AVM System 500 (Aussie Membrane): www.avmindustries.com/#sle.
2. Epro Waterproofing Systems; ECOLINE-S: www.eproserv.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

C. Polyurethane Waterproofing:

1. Karnak Corporation: www.karnakcorp.com/#sle.
2. Master Builders Solutions by BASF: www.master-builders-solutions.basf.us/en-us/#sle.
3. Tremco Commercial Sealants & Waterproofing; TREMproof 250GC: www.tremcosealants.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FLUID APPLIED WATERPROOFING MATERIALS

A. Hot-Applied Rubberized Asphalt Waterproofing: Elasticized rubberized asphaltic compound, hot-applied and quick setting.

1. Suitable for installation over concrete, gypsum board and plywood substrates.
2. Water Vapor Permeance: 0.016 perms (0.9 ng/(Pa s sq m)), maximum, measured in accordance with ASTM E96/E96M.

B. Cold-Applied Rubberized Asphalt Waterproofing: Rubberized asphaltic compound, suitable for installation on concrete and concrete masonry.

1. Cured Thickness: 60 mils, 0.060 inch (1.52 mm), minimum.
2. Complying with ICC-ES AC29; evidence of compliance includes current ICC-ES evaluation report citing ICC-ES AC29.
3. Hydrostatic Pressure Resistance: When tested in accordance with ASTM C1306/C1306M, at least 50 pounds per square inch (340 kPa) by the rapid test and at least 35 pounds per square inch (240 kPa) by the long term test.
4. Low Temperature Resistance: No cracking, loss of adhesion, splitting or pinholes when tested at minus 15 degrees F (minus 25 degrees C) in accordance with ASTM C836/C836M.
5. Adhesion: No separation when tested in accordance with ASTM C836/C836M.
6. Decay Resistance: No decay when tested in accordance with ASTM E154/E154M.
7. Wet Film Sag Resistance: No sag or sag within plus/minus 5 mils (0.1 mm) when tested in accordance with ASTM C836/C836M.
8. Water Vapor Permeance: Less than one perm (60 ng/(Pa s sq m)), when tested in accordance with ASTM E96/E96M.
9. Heat Aging Resistance: No cracking, splitting, or pinholes when tested in accordance with ASTM C836/C836M.
10. Elongation at Break: 1000 percent, minimum, when tested in accordance with ASTM D412.
11. Products:

a. Substitutions: See Section 01 6000 - Product Requirements.

C. Polyurethane Waterproofing: Cold-applied one or two component polyurethane, complying with ASTM C836/C836M.

1. Cured Thickness: 60 mils, 0.060 inch (1.52 mm), minimum.
2. VOC Content: None.
3. Tensile Strength: 400 psi (2.758 MPa), measured in accordance with ASTM D412.
4. Ultimate Elongation: 180 percent, measured in accordance with ASTM D412.
5. Durometer Hardness, Type A: 30, minimum, in accordance with ASTM D2240.
6. Adhesion: Greater than 150 psi (1.03 MPa), measured in accordance with ASTM D4541.
7. Brittleness Temperature: Based on minus 50 degrees F (minus 46 degrees C), measured in accordance with ASTM D746.
8. Products:
   a. Carlisle Coatings & Waterproofing, Inc; CCW 703 Liquiseal: www.carlisleccw.com/#sle.
   b. Gaco Western; GacoFlex LM-60: www.gaco.com/#sle.
   c. Tremco Commercial Sealants & Waterproofing; TREMproof 250GC: www.tremcosealants.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify substrate surfaces are free of frozen matter, dampness, loose particles, cracks, pits, projections, penetrations, or foreign matter detrimental to adhesion or application of waterproofing system.

C. Verify that substrate surfaces are smooth, free of honeycomb or pitting, and not detrimental to full contact bond of waterproofing materials.

D. Verify items that penetrate surfaces to receive waterproofing are securely installed.

3.02 PREPARATION

A. Protect adjacent surfaces from damage not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions; vacuum substrate clean.

C. Do not apply waterproofing to surfaces unacceptable to waterproofing manufacturer.

D. Fill non-moving joints and cracks with a filler compatible with waterproofing materials.

E. Seal moving cracks with sealant and non-rigid filler, using procedures recommended by sealant and waterproofing manufacturers.

F. Prepare building expansion joints at locations as indicated on drawings.

G. Install cant strips at inside corners.

3.03 INSTALLATION

A. Install waterproofing to specified minimum thickness in accordance with manufacturers instructions and NRCA (WM) applicable requirements.

B. Apply primer or surface conditioner at a rate recommended by manufacturer, and protect conditioner from rain or frost until dry.

C. Center joint cover sheet over joints, roll sheet into 1/8 inch (3.2 mm) thick coating of waterproofing material and apply second coat over sheet extending at least 6 inches (152 mm) beyond sheet edges.

D. Extend membrane over cants and up intersecting surfaces at membrane perimeter minimum 6 inches (150 mm) above horizontal surface for first ply and at subsequent plies laid in shingle fashion.

E. Extend waterproofing material and flexible flashing into drain clamp flange, apply adequate coating of liquid membrane to ensure clamp ring seal, and coordinate with drain installation requirements specified in Section 22 1006.

F. Seal membrane and flashings to adjoining surfaces.

3.04 FIELD QUALITY CONTROL

A. Owner will provide testing services in accordance with Section 01 4000 - Quality Requirements. Contractor shall provide temporary construction and materials for testing.

B. Upon completion of horizontal membrane installation, dam installation area in preparation for flood testing.

1. Flood to minimum depth of 1 inch (25 mm) with clean water, and after 48 hours inspect for leaks.
2. If leaking is found, remove water, repair leaking areas with new waterproofing materials as directed by Architect; repeat flood test, and repair damage to building.
3. When area is proven watertight, drain water and remove dam.

3.05 PROTECTION

A. Do not permit traffic over unprotected or uncovered membrane.

END OF SECTION

SECTION 07 1616
CRYSTALLINE WATERPROOFING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Crystalline waterproofing.

1.02 REFERENCE STANDARDS

A. COE CRD-C 48 - Standard Test Method for Water Permeability of Concrete.

1.03 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Test data showing hydraulic permeability.
2. Details for waterproofing at joints, intersections, and other special conditions.

B. Specimen warranty.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture of products of the type specified and providing technical representatives to visit project site.

B. Installer Qualifications: Acceptable to manufacturer, with documented experience on at least 5 projects of similar nature within the last 5 years.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Take necessary precautions to keep cementitious materials dry.

1.06 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide installer's warranty agreeing to correct leaking waterproofing for 2 years from the Date of Substantial Completion, unless leakage is caused by structural failure, movement of the structure, or other causes beyond the installer's control.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Crystalline Waterproofing:

1. Anti-Hydro International, Inc.; Hydro Cap.
2. Conproco Corp.; Super Seal.
3. Tamms Industries, Inc.; Hey'Di K-11.
4. ThoRoc, Div. of ChemRex; Tegraproof.
5. Tremco Incorporated; Permaquik Crystalline Waterproofing.
6. Xypex Chemical Corporation; Xypex.

2.02 APPLICATIONS

A. Waterproofing for building surfaces:

1. Inside of elevator pits.

2.03 MATERIALS

A. Crystalline Waterproofing: Portland cement and chemical compound that when applied to the surface of concrete forms insoluble crystals in the capillary pores preventing the passage of liquids, while having no adverse effect on the normal properties of concrete.

1. Hydraulic Permeability: No measurable leakage or water flow at 200 psi pressure when tested in accordance with COE CRD-C 48, using minimum 2 inch thick sample and 20 days duration.
2. Toxicity: Non-toxic.
3. Color: Gray.

B. Patching Compound: Ready-mixed cementitious mortar recommended or approved by waterproofing manufacturer.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions. Use sand blasting, water blasting, or acid etching as recommended.

C. Plug water leaks.

D. Patch holes, construction joints, and cracks. Remove defective concrete.

E. Obtain approval of manufacturer's field representative before beginning installation.

3.02 INSTALLATION

A. Install in strict accordance with manufacturer's instructions. Maintain environmental conditions required and recommended by manufacturer. Keep a copy of manufacturer's instructions on site.

B. Coordinate installation with installation of products that must penetrate waterproofed surfaces.

C. Prevent excessive drying of surface.

1. Cure waterproofing for at least 3 days, or length of time required by manufacturer, with water spray and adequate air circulation.
2. Do not use chemical curing agents unless explicitly approved by waterproofing manufacturer.

D. Do not backfill, fill water or liquid holding structures, or apply finish coatings until time period recommended by manufacturer has passed.

END OF SECTION

SECTION 07 1619
METAL OXIDE WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior waterproofing for concrete floors.

B. Interior waterproofing for concrete walls.

C. Interior waterproofing for masonry walls.

D. Protective coating for metallic oxide waterproofing.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete finishing requirements.

B. Section 07 9200 - Joint Sealants: Sealing moving joints in waterproofed surfaces.

C. Section 09 6613 - Portland Cement Terrazzo Flooring: Floor finish.

1.03 REFERENCE STANDARDS

A. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2016, with Editorial Revision (2016).

B. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar 2017.

C. ASTM C150/C150M - Standard Specification for Portland Cement 2018.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturers printed information, including mixing and installation instructions. Include factory test reports with:

1. Iron content of metallic waterproofing.
2. Oxidizing agent content of metallic waterproofing.

1.05 QUALITY ASSURANCE

A. Testing: Prepare a 100 gram sample. Using a magnet over a watch glass, transfer magnetic portion into separate pile leaving nonmagnetic behind. Weigh nonmagnetic portion.

1. Total iron content: Determine total iron by percentage of sample weight using standard qualitative chemical analysis procedures.
2. Oxidizing agent content: Determine percentage of oxidizing agent by standard qualitative chemical analysis technique.

B. Certification: Provide certified statement attesting that chemical and physical composition of metallic waterproofing material has been determined by testing methods above and material has been found to comply with specification requirements.

1.06 MOCK-UP

A. Apply metallic waterproofing to a test area not less than 100 square feet (1000 square meters) using materials and methods specified, at location indicated by Architect .

B. Examine waterproofing for bond and loose materials, using a wide-blade putty knife or similar tool, in presence of Architect . Failure of waterproofing to bond or appearance of excessive loose materials will be cause for disapproval of proposed material and method of application.

C. Clean disapproved test area free of applied finish, leaving base clean and acceptable for new application. If test area is disapproved, make an additional test area.

D. Do not apply waterproofing in other areas until application of test area has been approved by representative of waterproofing materials manufacturer and accepted by Architect .

E. Maintain approved installation in place and open to observation as criteria for all metallic waterproofing on project, until all other areas of waterproofing have been covered.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in original sealed containers with manufacturer's name and brand clearly identified.

B. Store in dry locations with adequate ventilation and handle in a manner to prevent damage or contamination.

1.08 FIELD CONDITIONS

A. Enclose or protect surfaces to be treated from excessive temperature changes. Ambient temperature shall be above 50 degrees F (10 degrees C) during application and for duration of curing period.

B. Keep water level below location of surfaces being treated until completion of the treatment and curing period.

C. Provide adequate ventilation to oxidize metallic waterproofing properly.

PART 2 PRODUCTS

2.01 MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I.

B. Fine Aggregate: ASTM C144 (sand) for waterproofing coats and ASTM C33/C33M for protective coat.

C. Water: Potable and free from injurious amounts of oil, alkalis, acids, organic matter, and other deleterious substances.

D. Metallic Waterproofing Compound: Clean, commercial, pulverized cast iron mixed in dust-confining container with chemical oxidizing agent such as sodium peroxide, potassium peroxide, or ammonium chloride.

1. Pulverized Cast Iron: 85 percent minimum by weight of metallic iron of magnetic portion. Chemical oxidizing agent content shall be a minimum of 3 percent and a maximum of 5 percent by weight of compound. Presence of dirt, paraffin, bitumen, or other foreign substances in excess of one percent by weight of waterproofing compound will be cause for rejection.

2. Iron Oxide Content: Do not exceed 5 percent by weight of magnetic iron. Magnetic portion of iron shall not contain more than 0.05 percent by weight of oil.

3. Magnetic Iron Particles Graded as follows:

    a. No. 20 Screen: 100 percent passing.

    b. No. 35 Screen: 95 to 100 percent passing.

    c. No. 40 Screen: 90 to 100 percent passing.

    d. No. 60 Screen: 65 to 100 percent passing.

    e. No. 100 Screen: 45 to 70 percent passing.

    f. No. 200 Screen: 10 to 25 percent passing.

E. Non-Moving Joint Filler: Type as recommended by waterproofing manufacturer.

2.02 MIXING

A. Follow mixing instructions supplied by the manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine all surfaces to be waterproofed to ensure that substrate has properly cured, all shrinkage has occurred, laitance has been removed, cracks and honeycombs have been cut out and filled, and surfaces have been roughened to provide bond for waterproofing material.

B. Correct all defects that will adversely affect proper completion of waterproofing.

3.02 SURFACE PREPARATION

A. Comply with waterproofing manufacturer's instructions and recommendations.

B. Concrete Surfaces:

1. Roughen concrete wall and floor surfaces by light bushhammering, sandblasting, acid etching or high pressure water cleaning to provide firm, unspalled granular surface, clean and free from loose materials, debris, and detrimental substances such as dust, dirt, oil, grease, or other coatings.

C. Walls:

1. Clean wall areas that have been cut out, moisten with water, and fill flush with a stiff mortar mix composed of one 94 pound (42.6 kilogram) sack of Portland cement, 188 pounds (85.3 kilograms) of sand, and 15 pounds (6.8 kilograms) of metallic oxide waterproofing compound.
2. Apply filling and patching in layers not exceeding 3/4 inch (19 mm) thickness, worked into voids, compacted, and finished flush with adjacent surfaces.
3. Roughen patched areas to provide level, firm, granular surface.

D. Grooves, Joints, and Intersections:

1. Strip, clean, and remove all loose material from construction joints, grooved recesses, and intersections of vertical and horizontal surfaces.
2. Pack nonmoving joints with waterproofing mortar mixed in proportions of one 94 pound (42.6 kilogram) sack of Portland cement and 188 pounds (85.3 kilograms) of sand, and 15 pounds (6.8 kilograms) of metallic oxide waterproofing compound. Finish compacted mortar flush with adjacent surfaces; finish internal angles to a round cove.
3. Clean expansion and control joints (moving joints) and keep clear of waterproofing materials.

E. Penetrations: Install joint filler around all items that penetrate the surfaces to be waterproofed, including but not limited to pipes, drains, and conduits.

F. Penetrations: Do not apply waterproofing until anchorage items or other items passing through or protruding from the surfaces have been installed. Treatment shall be completed and approved prior to attachment of utilities to anchorage items.

3.03 APPLICATION

A. Limits of Application:

1. Completely coat columns integral with exterior walls.
2. Return wall waterproofing at least 24 inches (600 mm) on interior concrete walls that are in place at the time of the waterproofing application.
3. Return wall waterproofing at least 48 inches (1200 mm) onto masonry walls that are in place at the time of the waterproofing application.

4. Return floor waterproofing at least 12 inches (300 mm) vertically up on the face of all interior walls, partitions, and interior columns in place at the time of waterproofing application.
5. Recesses: Waterproof recesses, but do not fill to a lesser opening dimension than detailed.

B. Walls, Columns and Floors:
1. Thoroughly dampen surfaces to receive waterproofing.
2. Apply coats of slurry as directed by manufacturer.
3. Apply two coats of thick slurry to each 100 square feet (10 square meters) of surface.
   a. First coat: 94 pounds (42.6 kilograms) of Portland cement, 188 pounds (85.3 kilograms) of sand, and 10 pounds (4.5 kilograms) of metallic oxide waterproofing compound.
   b. Second coat: Same mix as first coat except with 8 pounds (3.6 kilograms) of metallic oxide waterproofing for each 94 pounds (42.6 kilograms) of cement.
4. Apply each coat by brushing with stiff bristle brushes to seal all pores.
5. Allow sufficient time between coats to permit oxidation of material, but not more than 24 hours before application of subsequent treatment.
6. Periodically spray each coat with fine fog spray during oxidation period to ensure thorough curing.
7. Where air circulation is insufficient to properly oxidize waterproofing, provide fans or other means to ensure adequate circulation.

C. Bond Coat:
1. Prior to application of plaster, cement mortar topping or thick-set wall and floor finishes specified in other sections, apply a bond coat of metallic oxide waterproofing mixed in same proportions as specified for second coat.
2. Prior to application of protective finish coating specified in this section, apply a bond coat of metallic oxide waterproofing mixed in same proportions as specified for second coat on walls and columns.
3. Prior to bond coat application, thoroughly broom previously treated surfaces with thick bristle broom to remove all traces of unoxidized compound, and dampen with water.
4. Apply bond coat immediately before finish coat so there will be no premature curing or setting of bond coat before finish coat is applied.

D. Protective Finish Coating: Waterproofed surfaces not scheduled to receive plaster, floor topping, or other finish shall receive a protective coating applied directly over the bond coat.
1. Floors: After application of bond coat, apply protective topping of 1 1/2 inch (38 mm) minimum thickness.
   a. Mix topping in proportions by volume of one part Portland cement, one part sand, and two parts fine aggregate complying with ASTM C33/C33M and proportioned by volume.
   b. Perform mixing in a mechanical batching-type mixer for not less than 3 minutes after all materials have been included, using not more than 4 gallons (15 liters) of water for each bag of cement when floating is done by machine and 5 gallons (19 liters) for each bag of cement when floating is done by hand.
   c. After screeding to established finish lines and levels, compact and then float with wood floats or power floating machines.
   d. After finish has sufficiently hardened to prevent excess fine material from being worked to surface, steel trowel to obtain smooth surface free from defects and blemishes.

e. After topping has set to ring, trowel again to a burnished finish.

2. Curing: Protect finish coating from loss of moisture and cure by periodic fog spraying and cover with impervious sheeting or other approved method until coating has set.

END OF SECTION

SECTION 07 1713
BENTONITE WTAERPROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. The work of this section includes, but is not limited to the furnishing and installing the following materials, per project specifications and drawings, or as directed by bentonite waterproofing manufacturer:

1. Bentonite panel waterproofing membrane.
2. Bentonite geotextile waterproofing membrane.
3. Prefabricated drainage composite
4. All applicable accessory products.

1.02 SYSTEM DESCRIPTION

A. Provide bentonite waterproofing and prefabricated drainage composite system to prevent the passage of liquid water and install without defects, damage or failure.

B. Waterproofing shall consist of the following:

1. Biodegradable corrugated kraft board containing one pound per square foot of granular sodium bentonite.
2. Two high strength geotextiles interlocked encapsulating minimum 1.10-lbs per square foot granular sodium bentonite.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer’s product data, with complete general and specific installation instructions, recommendations, and limitations.

B. Product Samples: Submit representative samples of the following for approval:

1. Panel waterproofing membrane
2. Geotextile waterproofing membrane
3. Prefabricated drainage composites

C. Waterproofing Warranty: Submit a sample copy of the Manufacturer’s Waterproofing warranty complete with all coverage’s, limitations, and conditions.

D. Material Certificates: Submit certificate(s) signed by manufacturer certifying materials comply with specified performance characteristics and physical requirements. Submit certification that waterproofing system and components, drainage and protection materials are supplied by a single-source manufacturer.

E. Contractor Certificate: Submit written certification that installer has current Approved Applicator status with waterproofing material manufacturer.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Installing company should have at least three (3) years experience in work of the type required by this section, who can comply with manufacturer's warranty requirements, and who is an Approved Applicator as determined by waterproofing/drainage system manufacturer.

B. Manufacturer Qualifications: Bentonite waterproofing and all accessory products shall be provided by a single manufacturer with a minimum of 30 years experience in the direct production of bentonite waterproofing systems. Manufacturer shall be capable of providing field service representation during construction, approving an acceptable installer, recommending appropriate installation methods of the

bentonite waterproofing and prefabricated drainage system applied.

C. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field installation to establish procedures to maintain required working conditions and to coordinate this work with related and adjacent work. Verify that final waterproofing and waterstop details comply with waterproofing manufacturer's current installation requirements and recommendations. Pre-con meeting attendees should include representatives for the Owner, Architect, Contractor, waterproofing installer, concrete installer, excavating/backfill contractor, and mechanical and electrical contractors if work penetrates the waterproofing.

D. Materials: Obtain bentonite waterproofing products and prefabricated drainage materials from a single manufacturer.

E. Inspection: Manufacturer’s representative shall inspect waterproofing installation periodically during application to verify that waterproofing has been installed in accordance with manufacturer’s guidelines and recommendations.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery and Handling: Deliver materials in factory sealed and labeled packaging. Sequence deliveries to avoid delays, while minimizing on-site storage. Handle and store following manufacturer's instructions, recommendations and material safety data sheets. Protect from construction operation related damage, as well as, damage from weather, excessive temperatures and prolonged sunlight. Remove damaged material from site and dispose of in accordance with applicable regulations.

B. Storage: Do not double-stack pallets during shipping or storage. Protect waterproofing materials from moisture, excessive temperatures and sources of ignition. Provide cover, top and all sides, for materials stored on-site, allowing for adequate ventilation.

1.06 PROJECT CONDITIONS

A. Substrate Condition: Proceed with work only when substrate construction and preparation work is complete and in condition to receive waterproofing system. All plumbing, electrical, mechanical and structural items to be under or passing through the waterproofing shall be positively secured in their proper positions prior to waterproofing system installation. Substrate preparation shall be per waterproofing manufacturer’s guidelines.

B. Weather Conditions: Perform work only when existing and forecasted weather conditions are within the guidelines established by the manufacturer of the waterproofing materials. Do not apply waterproofing materials in areas of standing or active water; or over ice and snow. The Contractor shall maintain site conditions to remove standing water from precipitation or ground water seepage in a timely manner. Should waterproofing materials be subjected to pre-hydration as a result of prolonged immersion, inspection of the material and written acceptance from manufacturer will be required prior to concrete or backfill placement.

1.07 WARRANTY

A. Waterproofing Warranty: Upon completion and acceptance of the work required by this section, the waterproofing materials manufacturer shall provide a written five (5) year material warranty. Issuance of Manufacturer's Material Warranty requires the following:

1. Manufacturer's Approved Applicator shall install bentonite waterproofing system and prefabricated drainage composite in full accordance with manufacturer’s requirements.

2. Bentonite Waterstop must be installed in all applicable horizontal and vertical concrete construction joints and around applicable penetrations.

B. Manufacturer's warranty shall be independent from any other warranties made by the Contractor under requirements of the Contract Documents and may run concurrent with said warranties.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Provide bentonite waterproofing membrane and all applicable accessory products as manufactured by Colloid Environmental Technologies Company (CETCO), Arlington Heights, Illinois, or an approved substitution. Phone: (847) 392-5800; Fax: (847) 506-6195; Web-site: www.cetco.com.

2.02 MATERIALS

A. Sodium Bentonite: Specially selected Wyoming granular sodium bentonite with 90% passing through a 20-mesh sieve and less than 10% passing through a 200-mesh sieve. Sodium bentonite shall have a 2 gram free swell minimum volume of 16 cc and a maximum fluid loss of 18 ml in de-ionized water.

B. Bentonite Panel Waterproofing

1. Type 1 Panels: 1 lb. per square foot of specially treated granular sodium bentonite contained inside a biodegradable, corrugated kraft board measuring 48" x 48" x 3/16" thick.
2. Type 1-C Panels: same as Type 1 panels with the printed side of the kraft board treated with a clear, water-resistant coating.
3. Bentonite Geotextile Waterproofing Membrane: 4’ x 15’ roll of interlocked geotextiles encapsulating a minimum 1.10-lbs per square foot of granular sodium bentonite. Composite shall consist of one woven and one nonwoven polypropylene geotextile, interlocked using a needle-punching process that produces several interlocks per square inch over the entire area of the product. Typical membrane performance properties:

PROPERTY	TEST METHOD	TYPICAL VALUE
Hydrostatic Pressure Resistance	ASTM D 5385 mod.	231 ft.
Permeability	ASTM D 5084	1 x 10-9 cm/sec.
Grab Tensile Strength	ASTM D 4632	95 lbs.
Puncture Resistance	ASTM D 4833	100 lbs.
Low Temperature Flexibility	ASTM D 1970	Unaffected at -25°F
Peel Adhesion to Concrete	ASTM D 903 mod.	15 lbs. /in.

C. Accessory Waterproofing Products: All accessory waterproofing materials shall be provided by the bentonite waterproofing manufacturer or shall have manufacturer’s written approval for substitution.

1. Bentonite Sealant: Trowel grade sodium bentonite compound used as a detailing mastic around penetrations, corner transitions and grade terminations.
2. Bentonite Tubes: 2” diameter x 2’ long, water soluble tube container filled with granular sodium bentonite.
3. Granular sodium bentonite.
4. Seam Tape: 2” wide butyl rubber sealant tape.
5. Termination Bar: Min. 1” wide aluminum bar with pre-punched holes on 12” centering for fastening.

D. Prefabricated Drainage Composite

1. Vertical: Aquadrain 15XP - 4-ft by 52-ft roll of a three-dimensional polypropylene drainage core with a nonwoven geotextile adhered to one side to allow water passage while restricting soil particles. Composite includes a thin polyethylene sheet on the back of the drainage core.
    a. Compressive Strength: 15,000 psf

b. Water Flow Rate: 20 gpm/ft

c. Thickness: 7/16”

E. Deck Sub-Surface Drainage

1. Horizontal: Aquadrain 20H - 4-ft by 52-ft roll of a three-dimensional polypropylene drainage core with a nonwoven geotextile adhered to one side to allow water passage while restricting soil particles.

a. Compressive Strength: 21,000 psf

b. Flow Rate: 18 gpm/ft.

c. Thickness: 7/16”

PART 3 - EXECUTION

3.01 SUBSTRATE INSPECTION AND CONDITIONS

A. The installer shall examine conditions of substrates and other conditions under which this section work is to be performed and notify the contractor, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected and are acceptable for compliance with manufacturer's warranty requirements. General substrate conditions acceptable for the waterproofing installation are listed below. For conditions not covered in this Section, contact the waterproofing manufacturer for guidance.

B. Concrete Walls: Cast-in-place concrete to receive waterproofing shall be of sound structural grade with a smooth finish, free of debris, oil, grease, laitance, dirt, dust, or other foreign matter which will impair the performance of the waterproofing and drainage system and which do not comply with manufacturer's warranty requirements.

1. Form fins, ridges, and other protrusions shall be level and smooth with monolithic concrete surface. Honeycombing, aggregate pockets, tie-rod holes and other voids shall be completely filled with non-shrink cementitious grout and level with monolithic concrete wall surface.

C. Gravel Sub-Grade: Aggregate sub-grades shall consist of 3/4” stone or smaller and be rolled flat, free from any protruding sharp edges.

D. Mechanical Or Other Penetrations: Mechanical, structural, or architectural materials that will pass through the plane of the waterproofing membrane shall be properly installed and secured in their final position prior to installation of the waterproofing system.

3.02 SURFACE PREPARATION

A. Remove dirt, debris, oil, grease, cement laitance, or other foreign matter which will impair or negatively affect the performance of the waterproofing and drainage system.

B. Protect adjacent work areas and finish surfaces from damage or contamination from waterproofing products during installation operations.

3.03 GENERAL INSTALLATION GUIDELINES

A. Comply with contract documents and manufacturer's product data, including product application and installation instructions.

B. Prevent bentonite waterproofing products from hydrating before material is contained with backfill or concrete. When threat of rain is imminent, installed bentonite products not already contained by backfill should be covered with polyethylene sheeting to decrease the chance of hydration. Remove polyethylene prior to overburden or backfill operations.After any precipitation, standing water should be pumped away from waterproofing as soon as possible.

3.04 BENTONITE PANEL INSTALLATION

A. Use Type 1 Panels or Type 1-C Panels (one-side coated).

B. Trowel Bentonite sealant over all concrete construction joints 1/8” thick by 3” wide. Form Tie holes or recesses shall be completely filled with non-shrink cementitious grout. Trowel bentonite sealant 1/8" thick over each grouted form tie hole.

C. Trowel 3/4" continuous fillet of bentonite sealant in all inside corner transitions.

D. Install bentonite panels with the printed side facing installer and the print oriented horizontally. Turn Panel with print vertically oriented when transitioning around inside and outside wall corners.

E. Starting at a wall base corner, bend Volclay Panel along 1/3 panel "Starter Line" (printed on panel) and install with the kraft board corrugations and print vertically oriented. Cut the Panel at the bottom edge of the "Starter Line" so that the Panel can be extended 6" onto the footing. Secure Panels with washer-head fasteners along each edge. After installing corner Panel, install all succeeding Panels with kraft board corrugations and print horizontally oriented - continuing Panel onto footing minimum 6". Overlap all adjoining edges minimum 1-1/2". When applicable, the base Panel course shall overlap the underslab waterproofing a minimum 6" to form a continuous waterproofing layer.

F. Stagger vertical Panel overlap joints of succeeding courses by folding the next courses corner Panel on the 2/3 panel "Lap Line" (printed on panel) and install overlapping lower Panel course minimum 1-1/2”. After installing corner Panel, install all succeeding Panels with kraft board corrugations and print horizontally oriented - overlapping adjoining edges minimum 1-1/2".

G. Penetration: On flat surface cut Panel to fit around penetration. Immediately seal cut Panel edge by applying water with cloth or sponge prior to panel installation. After Panel is installed around penetration, trowel 3/4" thick fillet of bentonite sealant around the penetration and extending onto Panel 1-1/2" at a 1/8” minimum thickness.

   1. Multiple Penetrations: Trowel 1/2" thick layer of bentonite sealant covering entire area between penetrations and extend layer outside of penetration area minimum 3" to allow Panels to overlap. At base of each penetration apply 3/4" fillet of bentonite sealant over the main bentonite sealant layer. Cut Panels and overlap bentonite sealant layer a minimum 1-1/2".

H. Continue Panels up to grade line. Terminate Panels at grade under a 12" wide strip of UV resistant flashing secured with a rigid termination bar fastened 12" on center. Seal top edge of termination detail with UV resistant caulk. Consult manufacturer’s representative or manufacturer when special conditions exist.

I. Repair any small Panel damage by applying a 1/2” thick layer of Bentonite sealant. Repair any large Panel damage by placing a new panel into position.

3.05 BENTONITE GEOTEXTILE WATERPROOFING MEMBRANE INSTALLATION

A. Place geotextile directly on properly prepared substrate (white geotextile side down; dark gray geotextile side up facing installer) with adjoining edges overlapped a minimum of 4”. Stagger sheet end seams a minimum of 24”. Mechanically fasten or staple geotextile membrane as required to prevent movement from construction operations or concrete placement. When the slab is poured in sections, extend geotextile a minimum 12" beyond the slab edge to enable proper overlapping.

B. Install waterproofing system where shown on drawings in accordance with manufacturer’s detail for specific project condition(s).

C. Slab Penetrations: For all pipe, rebar, structural or other penetrations install waterproofing system in accordance with manufacturer’s standard detail for specific project condition(s).

D. Inspect finished geotextile installation and repair any damaged material prior to concrete slab placement.

E. Before placing concrete, lay bentonite tubes against the inside face of the wall at the wall/footing transition. Bentonite tubes should be positioned end-to-end forming a continuous line. Manually place a shovel of concrete over bentonite tubes to hold them in position prior to main concreting operation.

3.06 PREFABRICATED DRAINAGE COMPOSITE INSTALLATION

A. Vertical

1. Install the bottom course of Aquadrain 15XP sheet drainage (plastic core side against the wall) with the 15XP bottom core edge in contact with the footing. Secure sheet drain to wall with washer-head fasteners.
2. Install subsequent courses of Aquadrain 15XP sheet drainage in a shingle overlap style to finished grade or as shown on the project drawings. Prior to subsequent course, seal top and side core edges by tucking the products extra fabric edge flap behind the core before securing with washer-head fasteners. Install drainage sheet panels overlapped, bottom edge of higher course installed to the outside of the lower course to shed water like a roof shingle. Seal all outward overlap core edges by securing extra fabric flap with tape or general construction adhesive to filter fabric of previously installed sheet.
3. Around penetrations and other details, cut sheet drainage composite to fit and wrap extra filter fabric around open core edge to prevent soil from entering core.
4. At the top of the sheet drain installation, wrap the filter fabric flap behind the exposed top core edge to prevent intrusion of soil into the core and secure sheet drain to wall with termination bar fastened 12" on center.

3.07 BACKFILL EXCAVATED CAST-IN-PLACE CONCRETE WALLS

A. Care should be used during backfill operation to avoid damage to the waterproofing system. Follow generally accepted practices for backfilling and compaction. Backfill should be added in 6" to 12" lifts and compacted to a minimum 85% Modified Proctor density. Protection course required with gravel backfill. Limit gravel backfill to <3/4” angular aggregate with fines.

3.08 CLEAN UP

A. Clean areas where adjacent finished surfaces are soiled by work of this Section. Remove all tools, equipment and remaining product on-site. Dispose of section work debris and damaged product following all applicable regulations.

END OF SECTION

SECTION 07 1800
TRAFFIC COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Coating for waterproofing and traffic surface

1.02 REFERENCE STANDARDS

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension 2016.

B. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds 1998 (Reapproved 2010).

C. ASTM D4060 - Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser 2014.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2018b.

E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Include product characteristics and limitations. Identify dissolving solvents, fuels, and potential destructive compounds.

C. Manufacturer's Installation Instructions: Include special field conditions required to install traffic membrane and potential incompatibilities with adjacent materials.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than three years of documented experience.

1.05 MOCK-UP

A. Provide traffic coating & substrate mock-up, [20] feet ([6.09] m) long by [10] feet ([3.04] m) wide, with membrane system applied to representative substrate.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Maintain storage area at minimum ambient temperature of 55 degrees F (13 degrees C).

B. Keep away from fire or open flame.

1.07 FIELD CONDITIONS

A. Do not install materials when temperature is below 50 degrees F (10 degrees C) or above 90 degrees F (32 degrees C).

B. Maintain this temperature range, 24 hours before, during and 72 hours after application.

C. Restrict traffic from area where materials are being installed or are curing.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for repair and/or replacement.

1. Include coverage for delamination of system from substrate.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Polyurethane Traffic Coating:

1. Gaco Western: www.gaco.com/#sle.
2. Pacific Polymers International, Inc: www.pacpoly.com/#sle.
3. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Acrylic Traffic Coating:

1. GAF; StreetBond SB150 Pavement Coating: www.gaf.com/#sle.
2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 TRAFFIC COATINGS

A. Pedestrian Polyurethane Waterproof Coating System: Fluid applied polyurethane system with base and top coat.

1. Finished Coating Thickness: 55 mils, 0.055 inch (1.4 mm), minimum.
2. Color: Gray.
3. Manufacturers:
    a. Tremco Commercial Sealants & Waterproofing; Vulkem 350NF/351: www.tremcosealants.com/#sle.

B. Traffic Deck Waterproof Coating System: Modified polyurethane system with base coat, intermediate coat, and top coat.

1. Finished Coating Thickness: 49 mils, 0.049 inch (1.24 mm), minimum.
2. Color: Gray.
3. Manufacturers:
    a. Tremco Commercial Sealants & Waterproofing; Vulkem 350NF/950NF/951NF: www.tremcosealants.com/#sle.

C. Light Pedestrian, Low-Odor, Low-VOC Waterproof Coating System: Fluid applied, aliphatic urethane based system with single coating.

1. Finished Coating Thickness: 25 mils, 0.025 inch (0.635 mm), minimum.
2. Color: Gray.
3. Manufacturers:
    a. Tremco Commercial Sealants & Waterproofing; Vulkem OC810: www.tremcosealants.com/#sle.

D. Pedestrian Coating: Fluid-applied polyurethane with slip-reducing aggregate surface.

1. Finished Coating Thickness: 50 mils, 0.050 inch (1.3 mm), minimum.
2. Manufacturers:
    a. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.

E. Vehicular Coating: Fluid-applied polyurethane with slip-reducing aggregate surface.

1. Finished Coating Thickness: 50 mils (0.050 inch) (1.3 mm), minimum.
2. Manufacturers:
    a. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.

F. Vehicular Coating: Fluid-applied acrylic with slip-reducing aggregate surface.
1. Finished Coating Thickness: 50 mils (0.050 inch) (1.3 mm), minimum.
2. Manufacturers:
    a. GAF; StreetBond SB150 Pavement Coating: www.gaf.com/#sle.
    b. Substitutions: See Section 01 6000 - Product Requirements.

2.03 MATERIALS

A. Membrane: Fluid applied polyurethane; waterproof; color as selected; complying with the following:
1. Tensile Strength (ASTM D412).
2. Water Vapor Permeance (ASTM E96/E96M).
3. Surface Burning Characteristics (ASTM E84).
4. Adhesive Bond Peel Strength (ASTM D903).
5. Abrasion Resistance (ASTM D4060).

B. Surfacing: Clean sand.

C. Filler and Primer: As recommended by membrane manufacturer.

D. Cant Strips: 1 inch by 1 inch (25.4 mm by 25.4 mm) by 45 degrees, of dense sponge rubber compatible with adjacent materials.

E. Sealant: As recommended by membrane manufacturer, and compatible with system and adjacent materials.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate is ready to receive work, surface is clean, dry and free of substances that could adversely affect bond.

3.02 PREPARATION

A. Clean substrate surface free of foreign matter.

B. Patch wood substrate with latex filler to produce surface conducive to bond.

C. Patch concrete substrate with filler to produce surface conducive to bond.

D. Install cant strips securely at intersecting surfaces.

E. Protect adjacent surfaces.

3.03 INSTALLATION

A. Apply system materials in accordance with manufacturer's instructions.

B. Apply primer to prepared substrate to a dry film thickness of .

C. Apply surfacing to top coat before set.

D. Apply sealant to junction of horizontal and intersecting surfaces to achieve watertight seal.

3.04 PROTECTION

A. Do not permit traffic over unprotected surfaces.

END OF SECTION

SECTION 07 1900
WATER REPELLENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water repellents applied to exterior and interior, masonry, stone and concrete surfaces.

B. Pressure washing.

C. Concrete etching.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

1.03 REFERENCE STANDARDS

A. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a meeting at least one week prior to starting work; require attendance of affected installers; invite Architect and Owner .

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention; cautionary procedures required during application.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's Qualification Statement.

F. Installer's Qualification Statement.

G. Maintenance Materials: Furnish the following for Owner 's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience

C. Owner reserves the right to provide continuous independent inspection of surface preparation and application of water repellent.

1.07 MOCK-UP

A. Prepare a representative surface 36 inch by 36 inch (0.91 m by 0.91 m) in size using specified materials and preparation and application methods on surfaces identical to those to be coated; approved mock-up constitutes standard for workmanship.

B. Mock-up may remain as part of the Work.

1.08 FIELD CONDITIONS

A. Protect liquid materials from freezing.

B. Do not apply water repellent when ambient temperature is lower than 50 degrees F (10 degrees C) or higher than 100 degrees F (38 degrees C).

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty for all materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acrylic Water Repellents:

1. BASF Construction Chemicals: www.buildingsystems.basf.com/#sle.
2. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
3. Textured Coatings of America, Inc: www.texcote.com/#sle.

2.02 MATERIALS

A. Specific product to be used will be determined by side-by-side mock-up testing of at least three products meeting specified requirements; prepare mock ups as specified above; submit cost breakdown for each product used in mock-up, including both unit and total costs.

B. Water Repellent: Non-glossy, colorless, penetrating, water-vapor-permeable, non-yellowing sealer, that dries invisibly leaving appearance of substrate unchanged.

1. Applications: Vertical surfaces and non-traffic horizontal surfaces.
2. VOC Content: As specified in Section 01 6116.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify joint sealants are installed and cured.

C. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of water repellent.

3.02 PREPARATION

A. Protection of Adjacent Work:

1. Protect adjacent landscaping, property and vehicles from drips and overspray.
2. Protect adjacent surfaces not intended to receive water repellent.

B. Prepare surfaces to be coated as recommended by water repellent manufacturer for best results.

C. Do not start work until masonry mortar substrate is cured a minimum of 60 days.

D. Remove oil and foreign substances with a chemical solvent that will not affect water repellent.

E. Scrub and rinse surfaces with water and let dry.

F. Pressure wash surfaces to be coated:

G. Acid etch smooth concrete surfaces to be coated, using procedures described in MPI (APSM) - Architectural Painting Specifications Manual; match approved mock-up.

H. Allow surfaces to dry completely to degree recommended by water repellent manufacturer before starting coating work.

3.03 APPLICATION

A. Apply water repellent in accordance with manufacturer's instructions, using procedures and application methods recommended as producing the best results.

B. Apply at rate recommended by manufacturer, continuously over entire surface.

C. Remove water repellent from unintended surfaces immediately by a method instructed by water repellent manufacturer.

END OF SECTION

SECTION 07 2100
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation and integral vapor retarder at cavity wall construction, perimeter foundation wall, underside of floor slabs, over roof deck, over roof sheathing, exterior wall behind _ wall finish and interior wall with facer providing exposed finish.

B. Batt insulation and vapor retarder in exterior wall, ceiling and roof construction.

C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.02 RELATED REQUIREMENTS

A. Section 07 2500 - Weather Barriers: Separate air barrier and vapor retarder materials.

1.03 REFERENCE STANDARDS

A. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications 2013.

B. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation 2018.

C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation 2014.

D. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2018b.

F. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components 2012.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria and product limitations.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

1.05 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Insulation on Inside of Concrete and Masonry Exterior Walls: Glass fiber board.

B. Insulation in Metal Framed Walls: Batt insulation with integral vapor retarder.

C. Insulation in Wood Framed Walls: Batt insulation with separate vapor retarder.

D. Insulation in Wood Framed Ceiling Structure: Batt insulation with separate vapor retarder.

E. Insulation Above Lay-In Acoustical Ceilings: Batt insulation with no vapor retarder.

F. Insulation Over Roof Deck: Extruded polystyrene (XPS) board.

2.02 FOAM BOARD INSULATION MATERIALS

A. Expanded Polystyrene (EPS) Board Insulation: Complies with ASTM C578.
   1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   3. Manufacturers:
      a. AFM Corp: www.r-control.com/#sle.
      b. Diversifoam Products: www.diversifoam.com/#sle.
      c. Mar-flex Waterproofing & Building Products; ArmorFoam 25: www.mar-flex.com/#sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.

B. Termite-Resistant Expanded Polystyrene (EPS) Board Insulation: Complies with ASTM C578.
   1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.

C. Extruded Polystyrene (XPS) Board Insulation: Complies with ASTM C578 with either natural skin or cut cell surfaces.
   1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   3. Type and Thermal Resistance, R-value (RSI-value): Type IV, 5.0 (0.88) per 1 inch (25.4 mm) thickness at 75 degrees F (24 degrees C) mean temperature.
   4. Complies with fire resistance requirements shown on the drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.

2.03 FIBERBOARD INSULATION MATERIALS

A. Where fiberboard insulation is indicated, either glass fiber or mineral fiberboard insulation may be used, at Contractor's option.

B. Glass Fiberboard Insulation: Rigid glass fiber, in accordance with ASTM C612.
   1. Facing: None, unfaced.
   2. Flame Spread Index: 25 or less, when tested with facing, if any, in accordance with ASTM E84.
   3. Smoke Developed Index: 50 or less, when tested with facing, if any, in accordance with ASTM E84.
   4. Board Thickness: 1 inch (25.4 mm).

C. Mineral Fiberboard Insulation: Rigid or semi-rigid mineral fiber, ASTM C612 or ASTM C553; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
   1. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.

2.04 BATT INSULATION MATERIALS

A. Where batt insulation is indicated, either glass fiber or mineral fiber batt insulation may be used, at Contractor 's option.

B. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
   1. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.

C. Mineral Fiber Batt Insulation: Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.

1. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.

2.05 ACCESSORIES

A. Sheet Vapor Retarder: Specified in Section 07 2500.

B. Interior Vapor Retarder: Modified polyethylene/polyacrylate (PE/PA) film reinforced with polyethylene terephthalate (PET) fibers, 12 mils, 0.012 inch (0.30 mm) thick.

1. Width: 4.9 feet (1.5 m).

C. Tape: Reinforced polyethylene film with acrylic pressure sensitive adhesive.

1. Application: Sealing of interior circular penetrations, such as pipes or cables.

2. Width: Are required for application.

D. Flashing Tape: Special polyolefin film with high performance adhesive.

1. Application: Interior window and door sill flashing tape.

2. Width: Are required for application.

E. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 BOARD INSTALLATION AT FOUNDATION PERIMETER

A. Install boards horizontally on foundation perimeter.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.02 BOARD INSTALLATION AT EXTERIOR WALLS

A. Install boards horizontally on walls.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 BOARD INSTALLATION AT CAVITY WALLS

A. Install boards to fit snugly between wall ties.

B. Install boards horizontally on walls.

C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.04 BOARD INSTALLATION UNDER CONCRETE SLABS

A. Place insulation under slabs on grade after base for slab has been compacted.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

C. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.

3.05 BOARD INSTALLATION OVER LOW SLOPE ROOF DECK

3.06 BOARD INSTALLATION OVER STEEP SLOPE ROOF SHEATHING OR ROOF STRUCTURE

A. Installation of board insulation over steep slope roof structure or roof sheathing is specified in Section 06 1000.

3.07 BATT INSTALLATION

A. Install insulation and vapor retarder in accordance with manufacturer's instructions.

B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

3.08 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

3.09 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 2119
FOAMED-IN-PLACE INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Foamed-in-place insulation.
   1. In masonry cavity walls.
   2. In exterior framed walls.
   3. In exterior wall crevices.
   4. At junctions of dissimilar wall and roof materials.

B. Foamed-in-place intumescent insulation.

C. Protective intumescent coating.

1.02 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2017.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2018b.

C. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2004 (Reapproved 2012).

D. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials 2013.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than three years of documented experience.

1.05 MOCK-UP

A. Provide insulation mock-up, include insulation overcoat, wall construction, window and frame and door frame in mock-up.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

1.06 FIELD CONDITIONS

A. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.

B. Do not apply foam when temperature is within 5 degrees F (2.78 degrees C) of dew point.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Foamed-In-Place Insulation:
   1. Accella Polyurethane Systems: www.accellapolyurethane.com/#sle.
   2. BASF Corporation; WALLTITE US Series Closed Cell: www.spf.basf.com/#sle.

3. Demilec LLC; DEMILEC APX: www.demilec.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Monolithic Foamed-In-Place Intumescent Insulation:

1. Preferred Solutions, Inc; Staycell ONE STEP 255 Spray Foam Insulation: www.stayflex.com/#sle.

2.02 MATERIALS

A. Foamed-In-Place Insulation: Low-density, flexible, open celled, water vapor permeable polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.

1. Regulatory Requirements: Comply with applicable code for flame and smoke, concealment and overcoat limitations.
2. Thermal Resistance: R-value (RSI-value) of 3.0 (0.53), minimum, per 1 inch (25.4 mm) thickness at 75 degrees F (24 degrees C) mean temperature when tested in accordance with ASTM C518.
3. Air Permeance: 0.04 cfm/sq ft (0.2 L/second sq meter), maximum, when tested at intended thickness in accordance with ASTM E2178 or ASTM E283 at 1.57 psf (75 Pa).
4. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.

B. Monolithic Foamed-In-Place Intumescent Insulation: Medium-density, semi-rigid, two-part, closed cell polyurethane foam; foamed on-site using blowing agent of non-ozone-depleting gas.

1. Thermal Resistance: R-value (RSI-value) of 4.6 (0.81), minimum, per 1 inch (25.4 mm) thickness at 140 degrees F (60 degrees C) mean temperature, at 90 days, when tested in accordance with ASTM C518.
2. Water Vapor Permeance: 0.99 perms (56.64 ng/(Pa s sqm)), maximum, when tested at 2.4 inch (61 mm) thickness in accordance with ASTM E96/E96M.
3. Air Permeance: 0.0014 cfm/sq ft (0.007 L/second sq meter), maximum, when tested at 1-1/4 inch (31.8 mm) thickness in accordance with ASTM E2178 or ASTM E283 at 1.57 psf (75 Pa).
4. Closed Cell Content: At least 90 percent.
5. Density: 2.0 lbs/cu ft (32 kg/cu m), nominal, in accordance with ASTM D1622/D1622M.
6. Tensile Strength: 28 psi (193 kPa), minimum, in accordance with ASTM D1623.
7. Compressive Strength: 22 psi (152 kPa), minimum, in accordance with ASTM D1621.
8. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, maximum, at 4 inch (102 mm) thick when tested in accordance with ASTM E84.

2.03 ACCESSORIES

A. Primer: As required by insulation manufacturer.

B. Protective Coating: Intumescent coating of type recommended by insulation manufacturer and as required to comply with applicable codes.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify work within construction spaces or crevices is complete prior to insulation application.

B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation or overcoat adhesion.

3.02 PREPARATION

A. Mask and protect adjacent surfaces from over spray or dusting.

B. Apply primer in accordance with manufacturer's instructions.

3.03 APPLICATION

A. Apply insulation in accordance with manufacturer's instructions.

B. Apply insulation by spray method, to a uniform monolithic density without voids.

C. Apply overcoat monolithically, without voids to fully cover foam insulation, to achieve fire rating required.

D. Patch damaged areas.

E. Where applied to voids and gaps assure space for expansion to avoid pressure on adjacent materials that may bind operable parts.

F. Trim excess away for applied trim or remove as required for continuous sealant bead.

3.04 FIELD QUALITY CONTROL

A. Field inspections and tests will be performed by an independent testing agency under provisions of Section 01 4000 - Quality Requirements.

B. Inspection will include verification of insulation and overcoat thickness and density.

3.05 PROTECTION

A. Do not permit subsequent construction work to disturb applied insulation.

END OF SECTION

SECTION 07 2129
SPRAYED INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cellulosic insulation placed in walls.

B. Surface sealer.

1.02 REFERENCE STANDARDS

A. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2017.

C. ASTM C739 - Standard Specification for Cellulosic Fiber Loose-Fill Thermal Insulation 2017.

D. ASTM D1622/D1622M - Standard Test Method for Apparent Density of Rigid Cellular Plastics 2014.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2018b.

F. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C 2016a.

G. ITS (DIR) - Directory of Listed Products current edition.

H. UL (DIR) - Online Certifications Directory Current Edition.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on materials, describing insulation properties.

C. Certificates: Certify that products of this section meet or exceed specified requirements.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

E. Manufacturer's Qualification Statement.

F. Installer's Qualification Statement.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

C. Products Specified by Flammability Criteria: Listed and classified by ITS (DIR), UL (DIR) or authorities having jurisdiction (AHJ).

1.05 MOCK-UP

A. Provide air and water test mock-up, [8] feet ([2.5] m) long by [8] feet ([2.5] m) wide, illustrating wall construction.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

1.06 FIELD & ENVIRONMENTAL CONDITIONS

A. Do not install insulation, sealer when ambient and surface temperatures are lower than 40 degrees F. Install SPF within the range of ambient and substrate surface temperatures in accordance with manufacturer's written instructions. Do not apply SPF to damp or wet substrates. Do not apply SPF during inclement weather or when ice, frost, surface moisture, or visible dampness is present on surfaces to be covered, or when precipitation is imminent. Do not apply SPF to exterior building surfaces when wind speeds exceed 40 kilometers 25 miles per hour. Use moisture measuring methods and equipment to verify that the moisture conditions of substrate surfaces are in accordance with SPF manufacturer requirements prior to application. Substrate temperatures must be within Maintain acceptable ambient and substrate surface temperatures prior to, during, and after

   installation of primer and insulation materials and overcoat.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cellulosic Fiber Sprayed Insulation:

   1. GreenFiber: www.greenfiber.com/#sle.
   2. International Cellulose Corp: www.spray-on.com/#sle.
   3. ThermoCon, Inc: www.thermocon.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Fiberglass/Mineral Fiber Sprayed Insulation:

   1. CertainTeed Corporation: www.certainteed.com/#sle.
   2. Johns Manville: www.jm.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Cellulosic Fiber Insulation: ASTM C739; treated cellulosic fiber, white color.

   1. Thermal Resistance (R-value (RSI-value)): 3.9 (0.67), at 1 inch (25.4 mm) thick when tested in accordance with ASTM C177 at 75 degrees F (23 degrees C) temperature
   2. Density: 2 lb/cu ft (32 kg/cu m), when tested in accordance with ASTM D1622/D1622M.
   3. Noise Reduction Coefficient (NRC): 0.75 for 1 inch (25 mm) thickness.
   4. Moisture Absorption: Maximum 15 percent by weight.
   5. Flame Spread / Smoke Developed Index: 0-25 / 0-450, Class A, when tested in accordance with ASTM E84.
   6. Combustibility: Passing ASTM E136.

B. Provide blown insulation in accordance with requirements of Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

C. Thermal Resistance [R-value (RSI-value)]: Provided minimum values in accordance with applicable edition of ASHRAE Std 90.1 I-P for envelope requirements of building location and climate zone.

2.03 ACCESSORIES

A. Primer: As required by insulation manufacturer.

B. Surface Sealer: Clear, latex based for placement over insulation.

C. Insulation Stop: Plastic, profiled and sized to suit rafter spacing and wall/sloped roof configuration.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are clean, dry, and free of matter that may inhibit adhesion.

B. Verify that ceiling hangers and supporting clips have been are installed correctly.

C. Verify other work on and within spaces to be insulated is complete prior to application.

3.02 PREPARATION

A. Mask and protect adjacent surfaces from overspray or damage.

B. Apply primer in accordance with manufacturer's instructions.

C. Install insulation stops between rafters at wall/sloped roof construction to prevent insulation from covering soffit vents or from limiting air circulation from soffit to attic space.

3.03 INSTALLATION

A. Install sprayed insulation in accordance with manufacturer's instructions.

B. Install sprayed insulation to a uniform monolithic density without voids.

3.04 FIELD QUALITY CONTROL

A. Independent agency field inspection will be provided under provisions of Section 01 4000 - Quality Requirements.

B. Inspection will include verification of sprayed insulation and surface sealer thickness and density.

3.05 PROTECTION

A. Do not permit subsequent construction work to disturb applied sprayed insulation.

END OF SECTION

SECTION 07 2405
POLYMER BASED EXTERIOR INSULATION AND FINISH SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including Division 1 Specification Sections, apply to the Work of this Section.

1.02 DESCRIPTION OF WORK

A. Provide all labor, materials equipment and labor necessary to install the exterior insulation and finish system (EIF System-Class PB) indicated on the drawings.

B. Related work specified elsewhere:

1. Unit Masonry: Section 04 2000.
2. Joint Sealants: 07 9200
3. Gypsum Board Assemblies: Section 09 2116.

C. General System Description:

1. The exterior insulation and finish system shall be a field applied system consisting of expanded polystyrene insulation board (EPS), glass fabric reinforcing mesh, mechanical anchors, base coat, and finish coat(s).
2. The following is not acceptable:
    a. Non-mechanical adhesive systems (Exception: adhesive systems shall be acceptable for application over existing glass block).

1.03 QUALITY ASSURANCE

A. Single Source Responsibility: Provide only products supplied by a single EIFS manufacturer, purchased directly from the Manufacturer or its authorized distributor.

B. Qualifications

1. EIF Manufacturer:
    a. Shall have marketed exterior insulation and finish systems in the United States for at least 10 years.
    b. Shall have a record of satisfactory completion of at least 1,000 projects utilizing the specified EIF system(s).
    c. Shall be a member of the Exterior Insulation Manufacturer's Association (EIMA) and shall comply with EIMA Guide Specifications and Standards for PB Systems.
    d. Shall have been approved for use by the following Model Building Code organizations in published research or compliance reports:
        1) BOCA ES
        2) ICBO ES
        3) SBCCI (Southern Building Code Congress International) PST and ESI
2. Insulation Board Manufacturer:
    a. Shall be listed by the approved Manufacturer and capable of producing the expanded polystyrene (EPS) in accordance with EIFS Manufacturer’s specifications.

b. Shall participate in the EIFS Manufacturer's third party certification and quality assurance program.

3. Applicator:
   a. Shall have trained and approved in the installation of the approved system(s).
   b. Shall process a current certificate of membership in approved manufacturers trained network of applicators.
   c. Shall be experienced and competent in the installation of Class PB EIF Systems.
4. Performance Requirements:
   a. The EIF System shall have been tested for durability and shall have passed based on the following test procedures:
      1) Abrasion Resistance: ASTM D968 after 500 Liters.
      2) Freeze/Thaw Resistance: EIMA 101.01 (modified ASTM C67); 60 cycles.
      3) Accelerated Weathering: ASTM G23; 2000 hours.
      4) Mildew Resistance: MIL STD 810B or ASTM D3273.
      5) Moisture Resistance: ASTM D2247, 14 day exposure.
      6) Salt Spray: ASTM B117, 300 hours.
      7) Water Penetration: EIMA 101.02 (modified ASTM E331).
      8) Water Vapor Transmission: ASTM E96, Procedure B.
   b. The EIF System shall have been tested for structural Performance as follows:
      1) Impact resistance: EIMA 101.86, Ultra-High (>150 in-lbs,
      2) Full Scale Structural Tests: ASTM E330.
   c. The EIF System shall have been tested for fire characteristics as follows:
      1) Flame Spread/Smoke Development (ASTM E84):
         (a) Adhesives and coatings: Less than 20 and less than 10 respectively.
         (b) Insulation Board: Less than 25 and less than 450 respectively.
      2) ASTM E108 (Modified): No significant contribution to flame spread (horizontally or vertically).
      3) ASTM E119: No effect on rating of wall assemblies (where applicable).

1.04 SUBMITTALS

A. Samples:
   1. Submit samples of EIF System for approval prior to beginning work. Minimum size of samples shall be 12" X 12". Samples shall clearly indicate each component of the system and shall be of suitable size to accurately represent each required color and texture. Colors will be selected from the Manufacturer's standard chart.
   2. Each sample shall be fabricated using the same tools and techniques as required for the actual application.
   3. One (1) approved sample shall be available and maintained at the job site.

B. Shop Drawings:

1. Submit complete drawings showing wall layout, all details, connections, expansion joints, the system components and installation sequence.

C. Reports, Calculations, and Certificates:

1. Submit copies of selected test reports by independent laboratories verifying the performance of the finish system and insulation board.
2. When requested, submit engineering calculations verifying the structural performance of the EIF System.
3. Applicator shall submit a copy of his current certificate of membership as an approved applicator of the approved EIF System.

D. Installation Procedures: Submit copies of Manufacturers approved installation instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

A. All materials supplied by the Approved Manufacturer shall be delivered to the site location in the original unopened containers and packages with labels intact.

B. Upon arrival, materials shall be inspected for damage. Notify the manufacturer should damaged, incorrect or otherwise unsatisfactory material be encountered. Unsatisfactory materials, including coatings and admixtures damaged by freezing, shall not be used.

C. All materials shall be stored in a cool dry location, out of sunlight, protected from weather and other damage and at temperatures not less than 40 degrees F.

1.06 JOB CONDITIONS

A. Environmental Conditions:

1. The ambient air temperature shall be a minimum of 40 degrees F or greater and rising at the time of installation of the coatings and shall remain at 40 degrees F for at least 24 hours after application.
2. Application of the finish coat shall not take place during inclement weather unless appropriate protection acceptable to the manufacturer is employed.

B. Protection:

1. Surrounding materials and areas shall be protected during the installation of the EIF System.
2. The EIF System shall be protected from weather and other damage immediately after installation, including damage from installation of flashing and sealants.

C. Coordination and Scheduling:

1. Installation of system shall be coordinated with other construction trades.
2. Tops of walls shall be immediately covered to avoid water infiltration.
3. All sealants shall be installed in a timely manner to avoid water infiltration.
4. Sufficient manpower shall be employed to ensure a continuous operation, free of cold joints, scaffolding lines, or other conditions that would adversely affect integrity of system and finished appearance.

1.07 WARRANTY

A. The Approved Manufacturer shall provide a five (5) year limited warranty stating that all materials have been installed as specified and are free from defects in manufacturing and installation.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Polymer Based (PB) EIF System:

1. Dryvit "Outsulation” (with "Panzer 15 Mesh"). (Basis of Specification)
2. Finestone "Pebbletex 55" type PB (with "Hi-Impact" mesh)
3. STO "Classic System" Type PB (with "Armor Mat" mesh)
4. Other EIF System manufacturer(s), pre-bid approved in accordance with Section 01630 (Substitutions and Product Options).

2.02 MATERIALS

A. Expanded Polystyrene Insulation Board:

1. Shall meet ASTM specification ASTM C578, Type I
2. Nominal Density: Minimum 0.95 pcf; maximum 1.25 pcf
3. Minimum compressive strength: 10 psi
4. Maximum water absorption: 2.5% by volume
5. Shall be labeled with Model Building Code approvals and UL listings
6. Tested in accordance with ASTM E84 Tunnel Test
    a. Flame Spread: Not greater than 25
    b. Smoke Developed: Not greater than 450
7. Board Thickness: Minimum 3/4"; maximum 4”

B. Fasteners:

1. Expansion Fastener: Concrete and masonry substrates - expandable sheath with corrosion resistant hammer driven pin, pre-drilled and used with the manufacturer's washer attachment. Anchor spacing not to exceed 12" vertically and 16" horizontally, with minimum penetration of 1".
2. Screw: Steel stud/gypsum sheathing substrate screws shall be corrosion resistant steel drill screws meeting the requirements of ASTM C 1002. Screw threads shall be adequate to pull screw head below the surface of the insulation board using the manufacturer's washer attachment.

C. Adhesives (Glass Block Installations): Liquid Polymer, field mixed with Portland cement; “Primus”.

D. Reinforcing Mesh:

1. Shall be balanced, open weave glass fiber fabric.
    a. Panzer 15: 15 oz/sq. yd. Tensile Strength: 400 lbs/in.
    b. Corner Mesh: 7.2 oz/sq. yd. Tensile Strength: 274 lbs/in.

E. Base Coats:

1. PB (Polymer Based) System: "Primus" acrylic-based adhesive/base coat, field mixed with Portland cement in accordance with manufacturer's instructions. Shall be compatible with EPS insulation board and reinforcing meshes.

F. Finish Coat:

1. Water based acrylic coating, factory blended and integrally colored synthetic finish.
    a. Standard formulation with dirt pickup resistance (DPR); “Quarzputz” coarse texture.

G. Accessories: As indicated on the Drawings.

H. Sealants: Comply with manufacturer's recommendations and EIMA Guidelines for compatible sealants and application procedures.

PART 3 - EXECUTION

3.01 INSPECTION

A. Prior to beginning work, examine all substrates for soundness, such as tightness of connections, crumbling or looseness of surface, level tolerance of surface, and other conditions when would affect the installation.

1. Level tolerance: ¼” in a 4 foot radius.

B. Notify the Owner’s Representative and Architect of any adverse or unsatisfactory conditions encountered. Work shall not proceed until such conditions are corrected.

3.02 INSTALLATION

A. Installation shall conform to Approved Manufacturer's printed application instructions, except as otherwise specified herein or as shown on the drawings.

B. Insulation Board and Reinforcing Fabric:

1. Board shall be placed horizontally from a level base line, vertical joints shall be staggered and insulation boards interlocked at corners. Insulation boards shall be butted tightly. Surfaces of adjacent boards shall be flush at joints. Reinforcing glass fabric edges shall be overlapped 3". Insulation and reinforcing fabric shall be mechanically anchored with manufacturer's standard fasteners, spaced not more than 12" vertically nor more than 16" horizontally. Where required, provide expansion through both the reinforcing mesh and board. Vertical joints shall be continuous with butt end located at mid points of panel. Horizontal joints shall butt into vertical joints. Apply a bead of preliminary caulk at butt end conditions and intersections of vertical and horizontal joints.

a. The fasteners shall be installed so that the insulation board is pulled snug to the wall and is slightly dimpled by the washer.

C. Base Coat:

1. Base coat shall be mixed in accordance with manufacturer's instructions and applied to insulated wall surfaces trowelling the material into the reinforcing fabric in a tight coat and doubling back to 1/8" -3/16" thickness. (Refer to EIF System Application Instructions for proper thickness). Base coats shall be applied to level out surface areas and to fill joints smooth with adjacent area.

2. The mesh shall be fully embedded into the wet adhesive/base coat mixture. (Apply the base coat in two passes to ensure that the mesh pattern shall not be visible).

3. Allow the base coat to dry for a period of at least 24 hours before applying finish coat.

4. Correct surface imperfections prior to applying finish coat.

D. Finish Coat:

1. Finish shall be applied continuously and in one operation to the entire surface. A wet edge shall be maintained. Texture shall be maintained by trowelling, floating or spraying as necessary to achieve the required finish. Texture shall match approved sample. (See 1.04A3).

2. Protect the finish from dust or other airborne contamination and effects of weather until completely dry. Protect surface from construction damage until acceptance by Owner.

E. Installation on Existing Glass Block

1. Prior to installation of the EIFS, the existing glass block surface shall be completely cleaned with a mild detergent, rinsed with clean water, and allowed to dry. The surface shall be free of dirt, debris

and soap film, or other foreign surfaces.

2. Install a test sample approximately one foot square: Apply a sample of polystyrene insulation board to the cleaned glass block surface with manufacturer's adhesive/base coat. Adhesive base coat shall be properly mixed and applied in accordance with Manufacturer's recommendations. Allow sample to dry for minimum of 3 days or as otherwise recommended by the manufacturer.
3. Perform a “pull-off” test in the presence of an authorized representative of the system manufacturer and the Owner’s Representative. A successful test of adhesion is indicated by failure within the insulation board.
4. Do not proceed unless adhesion of test sample is satisfactory. Perform a second cleaning of glass block surface if adhesion proves inadequate, and perform a second "pull-off" test.

3.03 FIELD QUALITY CONTROL

A. During installation, the work shall be inspected by the approved manufacturer or its authorized representative in order to ensure compliance with installation instructions.

B. Make all repairs or modifications resulting from use of improper materials or procedures, at no additional cost to the Owner.

3.04 PROTECTION

A. Protect EIFS from weather and damage from work of other trades, until flashings and sealants are installed, and until completed system is accepted by Owner.

3.05 CLEAN-UP

A. Excess materials shall be removed and disposed of legally.

B. The applicator shall clean adjacent materials and surfaces and the work area to remove foreign materials resulting from the work of this Section.

END OF SECTION

SECTION 07 2410
POLYMER MODIFIED EXTERIOR INSULATION AND FINISH SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including Division 1 Specification Sections, apply to the Work of this Section.

1.02 DESCRIPTION OF WORK

A. Provide all labor, materials equipment and labor necessary to install the exterior insulation and finish system (EIF System – Class PM) indicated on the drawings.

B. Related work specified elsewhere:

1. Unit Masonry: Section 04 2000.
2. Joint Sealants: Section 07 9200.
3. Gypsum Board Assemblies: Section 09 2116

C. General System Description:

1. The exterior insulation and finish system shall be a field applied system consisting of extruded polystyrene insulation board (XPS), glass fabric reinforcing mesh, mechanical anchors, chopped fiberglass reinforcing fibers, base coat, and finish coat(s).

1.03 QUALITY ASSURANCE

A. Single Source Responsibility: Provide only products supplied by a single EIFS manufacturer, purchased directly from the Manufacturer or its authorized distributor.

B. Qualifications

1. EIFS Manufacturer:
    a. Shall have marketed exterior insulation and finish systems in the United States for at least 10 years.
    b. Shall have a record of satisfactory completion of at least 1,000 projects utilizing the specified EIF system(s).
    c. Shall be a member of the Exterior Insulation Manufacturer's Association (EIMA) and shall comply with EIMA Guide Specifications and Standards for PM Systems.
    d. Shall be approved for use by the following Model Building Code organizations in published research or compliance reports:
        1) BOCA ES
        2) ICBO ES
        3) SBCCI (Southern Building Code Congress International) PST and ESI.
2. Insulation Board Manufacturer:
    a. Shall be listed by the approved manufacturer and capable of producing the extruded polystyrene (XPS) in accordance with EIFS Manufacturer’s specifications.
    b. Shall participate in the EIFS Manufacturer’s third party certification and quality assurance program.
3. Applicator:

a. Shall be trained and approved in the installation of the approved system.

b. Shall process a current certificate of membership in approved manufacturers trained network of applicators.

c. Shall be experienced and competent in the installation of Class PM EIF Systems.

4. Performance Requirements:

a. The EIF System shall have been tested for physical and chemical characteristics and shall have passed based on the following test procedures:

1) Absorption/Freeze/Thaw resistance: EIMA 101.1 (Modified ASTM C67); 60 cycles.

2) Salt Spray Resistance: ASTM B117; 300 hours.

3) Mildew Resistance: MIL STD 810B; Method 508.

4) Abrasion Resistance: ASTM D968; 500 liters.

5) Accelerated Weathering: ASTM G23; 2000 hours.

b. The EIF System shall have been tested for structural performance as follows:

1) Compressive Strength and tensile Strength: ASTM C190.

2) Flexural Strength: ASTM C203.

3) Impact Resistance: ASTM E695.

4) Full Scale Structural Test: ASTM E330.

c. The EIF System shall have been tested for fire characteristics as follows:

1) Flame Spread per ASTM E84: Less than 25 for EIFS coatings.

2) Systems Tests:

(a) Diversified Fire Test: ASTM E108 (Modified)

(b) Multi-Story Fire Test: UBC 17-6.

1.04 SUBMITTALS

A. Samples:

1. Submit samples of EIF System for approval prior to beginning work. Minimum size of samples shall be 12” X 12”. Samples shall clearly indicate each component of the system and shall be of suitable size to accurately represent each required color and texture. Colors will be selected from the Manufacturer's standard chart.

2. Each sample shall be fabricated using the same tools and techniques as required for the actual application.

3. One (1) approved sample shall be available and maintained at the job site.

B. Shop Drawings:

1. Submit complete drawings showing wall layout, all details, connections, expansion joints, the system components and installation sequence.

C. Reports, Calculations, and Certificates:

1. Submit copies of selected test reports by independent laboratories verifying the performance of the finish system and insulation board.

2. When requested, submit engineering calculations verifying the structural performance of the EIF System.

3. Applicator shall submit a copy of his current certificate of membership as an approved applicator of the approved EIF System.

D. Installation Procedures: Submit copies of Manufacturers approved installation instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

A. All materials supplied by the Approved Manufacturer shall be delivered to the site location in the original unopened containers and packages with labels intact.

B. Upon arrival, materials shall be inspected for damage. Notify the manufacturer should damaged, incorrect or otherwise unsatisfactory material be encountered. Unsatisfactory materials, including coatings and admixtures damaged by freezing, shall not be used.

C. All materials shall be stored in a cool dry location, out of sunlight, protected from weather and other damage and at temperatures not less than 40 degrees F.

1.06 JOB CONDITIONS

A. Environmental Conditions:

1. The ambient air temperature shall be a minimum of 40 degrees F or greater and rising at the time of installation of the coatings and shall remain at 40 degrees F for at least 24 hours after application.

2. Application of the finish coat shall not take place during inclement weather unless appropriate protection acceptable to the manufacturer is employed.

B. Protection:

1. Surrounding materials and areas shall be protected during the installation of the EIF System.

2. The EIF System shall be protected from weather and other damage immediately after installation, including damage from installation of flashing and sealants.

C. Coordination and Scheduling:

1. Installation of system shall be coordinated with other construction trades.

2. Tops of walls shall be immediately covered to avoid water infiltration.

3. All sealants shall be installed in a timely manner to avoid water infiltration.

4. Sufficient manpower shall be employed to ensure a continuous operation, free of cold joints, scaffolding lines, or other conditions that would adversely affect integrity of system and finished appearance.

1.07 WARRANTY

A. The Approved Manufacturer shall provide a five (5) year limited warranty stating that all materials have been installed as specified and are free from defects in manufacturing and installation.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Polymer Modified (PM) EIF System:

1. Dryvit "Ultralation" System (Type PM). (Basis of Specification)

2. "Finestone" Class PM "Impact-R" EIFS

3. STO "Toughwall"

4. Other PM EIF System Manufacturer(s), pre-bid approved in accordance with Section 01630 (Substitutions and Product Options).

2.02 MATERIALS

A. Extruded Polystyrene Insulation Board:

1. Shall meet ASTM specification ASTM C578, Type IV
2. Nominal Density: 2.0 PCF
3. Minimum compressive strength: 40 PSI (ASTM C 1621-73)
4. Maximum water absorption: 3% by volume (ASTM C272-76)
5. Shall be labeled with Model Building Code approvals and UL listings
6. Tested in accordance with ASTM E84 Tunnel Test
    a. Flame Spread: Not greater than 25
    b. Smoke Developed: Not greater than 450
7. Board Thickness: 1" minimum to 2” maximum

B. Fasteners:

1. Expansion Fastener: Concrete and masonry substrates - expandable sheath with corrosion resistant hammer driven pin, pre-drilled and used with the manufacturer's washer attachment. Anchor spacing not to exceed 12" vertically and 16" horizontally, with minimum penetration of 1".
2. Screw: Steel stud/gypsum sheathing substrate screws shall be corrosion resistant steel drill screws meeting the requirements of ASTM C 1002. Screw threads shall be adequate to pull screw head below the surface of the insulation board using the manufacturer's washer attachment.

C. Reinforcing Fabric:

1. Shall be balanced, open weave glass fiber mesh for reinforcement of starter base coat; “Utramesh”.

D. Base Coats:

1. PM (Polymer Modified) System:
    a. Portland Cement: ASTM C150, Type I
    b. Sand: Dry, bagged; #40-45 sieve silica or bulk sand complying with ASTM C 897
    c. Chopped fiberglass strands; “Ultrafibers”.
    d. Acrylic based additive, field mixed with cement, sand and fibers in accordance with manufacturer's instructions.

E. Finish Coat:

1. Water based acrylic coating; factory blended and integrally colored synthetic finish.

F. Accessories (As indicated on the Drawings): Expansion joints, control joints and corner beads of zinc or exterior grade vinyl as supplied by EIF System manufacturer.

G. Sealants: Comply with manufacturer's recommendations and EIMA Guidelines for compatible sealants and application procedures.

H. Water: Clean, cool and potable.

PART 3 - EXECUTION

3.01 INSPECTION

A. Prior to beginning work, examine all substrates for soundness, such as tightness of connections, crumbling or looseness of surface, level tolerance of surface, and other conditions when would affect the installation.

1. Level Tolerance: ¼” in a 4 foot radius.

B. Notify the Owner’s Representative and Architect of any adverse or unsatisfactory conditions encountered. Work shall not proceed until such conditions are corrected.

3.02 INSTALLATION

A. Installation shall conform to Approved Manufacturer's printed application instructions, except as otherwise specified herein or as shown on the drawings.

B. Insulation Board:

1. The insulation board shall be mechanically fastened to the substrate using one (1) fastener every eight (8) sq. ft.
2. The fasteners shall be installed so that the insulation board is pulled snug to the wall.
3. At penetrations where control joints are not used, the insulation board shall be installed so that its edges do not coincide with the corners of the opening.
4. A ½ in wide by ¾ in deep groove shall be cut into the insulation board to accommodate the “Deep V” control joints. The groove shall be cut so that a minimum of 6 mm (1/4 in) of insulation remains at the base of the groove.
5. Protect the finish from dust or other airborne contamination and effects of weather until completely dry. Protect surface from construction damage until acceptance by Owner.

C. Reinforcing Mesh:

1. Mesh shall be installed over the entire face of the wall and fastened through the insulation board and into the structural substrate. Ends of mesh shall overlap a minimum of 2 ½ in to a maximum of 4 in.
2. The remaining fasteners shall be installed to complete a 12 in by 16 in pattern and shall be installed so that the face of the washer sits not more than 1/16 in above or below the face of the insulation board.
3. Care shall be taken to ensure that mesh lays flat and has no tears, wrinkles, waves or cuts.

D. Trim Accessories:

1. Control joints, corner reinforcing, and other trim accessories shall be properly located and fastened into the insulation board using all nylon fasteners.
2. At all control joint intersections, neutral cure silicone bedding sealant, such as DOW Corning 790, shall be applied in the routed groove, and the control joint is set into the sealant so that the gaps between the joints are completely sealed.

E. Starter Base:

1. General:
    a. Prior to application of the Starter base coat, the surface of the insulation board shall be inspected by the applicator as follows:
        1) Fasteners, control joints and other trim accessories are properly installed and spaced.
        2) The Ultramesh shall lay flat with no wrinkles, tears, waves or cuts.
        3) All insulation board gaps greater than 1/8 in shall be silvered with insulation board.
        4) There shall be no surface degradation of the insulation board due to weathering. Affected areas shall be corrected by replacing, sanding or high pressure washing.
2. Mixing:

a. Mix the Starter base coat in the following proportions in accordance with manufacturers written instructions.

b. No other additives, except water, of any kind shall be added.

3. Base Coat Application:

a. Apply a tight coat of Starter mixture to fully embed the mesh.

b. Immediately double back, adding additional material as needed to achieve a smooth surface 6 mm (1/4 in) to 10 mm (3/8 in) thick.

c. Strike to a smooth level plane using a rod, darby or similar tool.

d. Apply starter mixture to entire panels, without interruption, to avoid cold joints.

e. The desired texture shall be applied to the set base coat using the Starter mixture.

F. Finish Application:

1. The finish shall be applied to distinct wall surfaces in a continuous application.

2. Sufficient manpower, scaffolding and equipment shall be employed to ensure a continuous operation and a uniform appearance.

3. Finish shall be protected from airborne contamination such as dust, soot, etc. and from weather and other damage until dry.

4. No additives shall be added under any circumstances.

5. Finish shall be applied utilizing the same tools and techniques to match the approved sample.

G. Sealants and Flashings:

1. All sealants and flashings shall be installed as soon as practical after completion of system installation and shall be designed and installed so that no water enters behind the system.

2. Temporary protection shall be provided until sealants and flashings are installed to prevent damage from water entry behind the System.

H. Protect the finish from dust or other airborne contamination and effects of weather until completely dry. Protect surface from construction damage until acceptable by Owner.

3.03 FIELD QUALITY CONTROL

A. During installation, the work shall be inspected by the approved manufacturer or its authorized representative in order to ensure compliance with installation instructions.

B. Make all repairs or modifications resulting from use of improper materials or procedures, at no additional cost to the Owner.

3.04 PROTECTION

A. Protect EIF System from weather and damage from work of other trades, until flashings and sealants are installed, and until completed system is accepted by Owner.

3.05 CLEAN-UP

A. Excess materials shall be removed and disposed of legally.

B. The applicator shall clean adjacent materials and surfaces and the work area to remove foreign materials resulting from the work of this Section.

END OF SECTION

SECTION 07 2500
WEATHER BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water-Resistive Barrier: Under exterior wall cladding, over sheathing or other substrate; not air tight or vapor retardant.

B. Vapor Retarders: Materials to make exterior walls, joints between exterior walls and roof and joints around frames of openings in exterior walls water vapor resistant and air tight.

C. Air Barriers: Materials that form a system to stop passage of air through exterior walls, joints between exterior walls and roof and joints around frames of openings in exterior walls.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Vapor retarder under concrete slabs on grade.

B. Section 07 5100 - Built-Up Bituminous Roofing: Vapor retarder installed as part of roofing system.

C. Section 07 5200 - Modified Bituminous Membrane Roofing: Vapor retarder installed as part of roofing system.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.

B. AATCC Test Method 127 - Water Resistance: Hydrostatic Pressure Test 2014.

C. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection 2017.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2018b.

E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.

F. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials 2013.

G. ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers 2016.

H. ICC-ES AC212 - Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers over Exterior Sheathing 2015.

I. ICC-ES AC380 - Acceptance Criteria for Termite Physical Barrier Systems 2014, with Editorial Revision (2017).

J. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components 2012.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on material characteristics.

C. Shop Drawings: Provide drawings of special joint conditions.

D. ABAA Field Quality Control Submittals: Submit third-party reports of testing and inspection required by ABAA QAP.

E. Manufacturer's Installation Instructions: Indicate preparation.

F. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

G. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification; keep copies of each contractor accreditation and installer certification on site during and after installation, and present on-site documentation upon request.

H. Testing Agency Qualification Statement.

1.05 QUALITY ASSURANCE

A. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); www.airbarrier.org/#sle:

1. Installer Qualification: Use accredited contractor, certified installers, evaluated materials, and third-party field quality control audit.

2. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture, and use secondary materials approved in writing by primary material manufacturer.

1.06 MOCK-UP

A. Install air barrier, vapor retarder and water-resistive barrier mock-up use materials specified.

1.07 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

PART 2 PRODUCTS

2.01 WEATHER BARRIER ASSEMBLIES

A. Water-Resistive Barrier: Provide on exterior walls under exterior cladding.

1. Use building paper unless otherwise indicated.

2. Under siding, use two separate layers of building paper.

B. Air Barrier:

1. On outside surface of inside wythe of exterior masonry cavity walls use air barrier coating.

2. On outside surface of single wythe masonry and concrete exterior walls use air barrier weather barrier as specified on drawing.

3. On outside surface of sheathing of exterior walls use air barrier weather barrier as specified on drawing.

C. Interior Vapor Retarder:

1. On inside face of studs of exterior walls, under cladding, use mechanically fastened vapor retarder sheet.

2. On bottom face of rafters, under cladding, use mechanically fastened vapor retarder sheet.

3. On inside face of masonry and concrete walls use vapor retarder weather barrier as specified on drawing.

4. On elevated floors over enclosed soffit space use vapor retarder .

5. On elevated floors over crawl space use vapor retarder .

D. Exterior Vapor Retarder:

1. On outside surface of inside wythe of masonry cavity wall use vapor retarder coating.

2.02 WATER-RESISTIVE BARRIER MATERIALS (NEITHER AIR BARRIER OR VAPOR RETARDER)

A. Building Paper: Asphalt-saturated Kraft building paper complying with requirements of ICC-ES AC38 Grade D.

1. Water Penetration Resistance: Withstand a water head of 21 inches (55 cm), minimum, for minimum of five hours, when tested in accordance with AATCC Test Method 127.
2. Manufacturers:
    a. Fortifiber Building Systems Group; Super Jumbo Tex 60 Minute: www.fortifiber.com/#sle.
    b. Fortifiber Building Systems Group; HydroTex: www.fortifiber.com/#sle.
    c. Substitutions: See Section 01 6000 - Product Requirements.

B. Weather-Resistive Barrier, Composite: Tear-resistant polyester sheet with UV-resistant acrylic coating.

1. Air Permeance: 0.178 cubic feet per minute per square foot (0.09 L/s/sq m), maximum, when tested in accordance with ASTM E2178.
2. Water Vapor Permeance: 200 perms (11.4 micrograms/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M Procedure A (desiccant procedure).
3. Ultraviolet and Weathering Resistance: Approved in writing by manufacturer for up to 210 days of weather exposure.
4. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less (Class A), when tested in accordance with ASTM E84.
5. Seam and Perimeter Tape: As recommended by sheet manufacturer.

C. Drainable Barrier Sheet: Non-woven and non-perforated polypropylene material with 1/16 inch (1.5 mm) gap created by spacers providing drainage space.

1. Width: 5 feet (1.52 m), minimum.
2. Water Vapor Permeance: 19 perms (1087 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M Procedure A (desiccant procedure).
3. Ultraviolet and Weathering Resistance: Approved in writing by manufacturer for up to 120 days of weather exposure.
4. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less (Class A), when tested in accordance with ASTM E84.
5. Seam and Perimeter Tape: As recommended by sheet manufacturer.
6. Manufacturers:
    a. Tamlyn; Drainable Wrap - TWD5X100: www.tamlyn.com/#sle.
    b. Substitutions: See Section 01 6000 - Product Requirements.

2.03 AIR BARRIER MATERIALS (WATER VAPOR PERMEABLE AND WATER-RESISTIVE)

A. Air Barrier, Fluid Applied: Vapor permeable, elastomeric waterproofing.

1. Air Barrier Coating:
    a. Air Permeance: 0.001 cubic feet per minute per square foot (0.005 L/s/sq m), maximum, when tested in accordance with ASTM E2178.
    b. Water Vapor Permeance: 18 perms (1030 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M, Procedure B.

c. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to six months of weather exposure after application.

d. Complies with NFPA 285 wall assembly requirements.

e. Nail Sealability: Pass, when tested in accordance with ASTM D1970/D1970M.

f. Manufacturers:

1) 3M Company: www.3M.com/construction/#sle.

2) BASF Corporation; MasterSeal AWB 660: www.master-builders-solutions.basf.us/#sle.

3) Dow Chemical Company; DOWSIL DefendAir 200: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.

4) Substitutions: See Section 01 6000 - Product Requirements.

2. Air Barrier Membrane:

a. Air Permeance: 0.004 cubic feet per minute per square foot (0.02 L/s/sq m), maximum, when tested in accordance with ASTM E2178.

b. Water Vapor Permeance: 5 perms (287 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M, Procedure B.

c. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to three months of weather exposure.

d. Nail Sealability: Pass, when tested in accordance with ASTM D1970/D1970M.

3. Foamed-in-Place Air and Vapor Barrier: Medium-density, rigid or semi-rigid, closed cell polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.

a. Regulatory Requirements: Comply with applicable code for flame and smoke limitations.

b. Water Vapor Permeance: Vapor retarder; 2 perm (115 ng/(Pa s sqm)), maximum, when tested at intended thickness in accordance with ASTM E96/E96M, desiccant method.

c. Closed Cell Content: At least 90 percent.

B. Air Barrier, Trowel-Applied:

1. Air Permeance: 0.004 cubic feet per minute per square foot (0.02 L/s/sq m), maximum, when tested in accordance with ASTM E2178.

2. Water Vapor Permeance: 10 perms (572 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M Procedure A (desiccant procedure).

3. Water Penetration Resistance Around Nails: Pass, when tested in accordance with ASTM D1970/D1970M (modified).

4. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 180 days of weather exposure.

5. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less (Class A), when tested in accordance with ASTM E84.

6. Code Acceptance: Comply with applicable requirements of ICC-ES Acceptance Criteria AC212.

7. Seam Tape, Perimeter Tape, and Sealants: As recommended by sheet manufacturer.

2.04 AIR BARRIER MATERIALS (AIR AND VAPOR BARRIER)

A. Air and Vapor Barrier Sheet, Self-Adhered:

1. Air Permeance: 0.0002 cubic feet per minute per square foot (0.001 L/s/sq m), maximum, when tested in accordance with ASTM E2178.
2. Water Vapor Permeance: 0.02 perms (1.14 ng/(Pa s sq m)), maximum, when tested in accordance with ASTM E96/E96M.
3. Water Penetration Resistance Around Nails: Pass, when tested in accordance with ASTM D1970/D1970M (modified).
4. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 30 days of weather exposure.
5. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less (Class A), when tested in accordance with ASTM E84.
6. Seam and Perimeter Tape: As recommended by sheet manufacturer.
7. Manufacturers:
    a. Tremco Commercial Sealants & Waterproofing; ExoAir 110AT: www.tremcosealants.com/#sle.
    b. Substitutions: See Section 01 6000 - Product Requirements.

B. Air and Vapor Barrier Sheet, Fluid-Applied:
1. Air Permeance: 0.0001 cubic feet per minute per square foot (0.0005 L/s/sq m), maximum, when tested in accordance with ASTM E2178.
2. Water Vapor Permeance: 0.1 perms (5.72 ng/(Pa s sq m)), maximum, when tested in accordance with ASTM E96/E96M Procedure A (desiccant procedure).
3. Water Penetration Resistance Around Nails: Pass, when tested in accordance with ASTM D1970/D1970M.
4. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less (Class A), when tested in accordance with ASTM E84.
5. Complies with NFPA 285 wall assembly requirements.
6. Seam and Perimeter Tape: As recommended by sheet manufacturer.

2.05 VAPOR RETARDER MATERIALS (AIR BARRIER AND WATER-RESISTIVE)

A. Vapor Retarder Sheet: ASTM D1970/D1970M.
1. Type: Rubberized asphalt bonded to thermoplastic sheet, self-adhesive.
2. Seam and Perimeter Tape: As recommended by sheet manufacturer.

B. Vapor Retarder Coating: Liquid applied, resilient, UV-resistant coating and associated joint treatment.
1. Water Vapor Permeance: 1.0 perm (57 ng/(Pa s sq m)), maximum, when tested in accordance with ASTM E96/E96M.
2. VOC Content: Less than 50 g per L when tested in accordance with 40 CFR 59, Subpart D (EPA Method 24).
3. Resistance to Fungal Growth: No growth when tested according to ASTM D5590.
4. Suitable for use on concrete, masonry, plywood and gypsum sheathing.
5. Joint Preparation Treatment: Coating manufacturer's recommended method, either tape or reinforcing mesh saturated with coating material.
6. Joint Filler: As recommended by coating manufacturer and suitable to the substrate.

2.06 ACCESSORIES

A. Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.

B. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M, except slip resistance requirement is waived if not installed on a roof.

1. Composition: Any material that meets physical requirements of ASTM D1970/D1970M with exceptions indicated.

C. Termite-Resistant Barrier Foundation Flashing: Peel and stick flashing membrane; polyethylene film bonded to sealant.

1. Thickness: 40 mil, 0.040 inch (1.016 mm) overall.
2. Roll Width: 12 inch (305 mm).
3. Termite Resistance: 100 percent when tested in accordance with ICC-ES AC380.

D. Pre-formed Transition Membrane: Semi-rigid silicone or polyester composition, tapered edges, tear resistant.

E. Liquid Flashing: One part, fast curing, non-sag, elastomeric, gun grade, trowelable liquid flashing.

F. Stainless Steel Flashing: Flexible flashing with 8 mil, 0.008 inch (0.203 mm) thick sheet of Type 304 stainless steel, 8 mil, 0.008 inch (0.203 mm) of butyl adhesive and a siliconized release liner.

G. Vapor Retarder Tape: Coated polyester film with acrylic adhesive backing; pressure sensitive.

H. Sheet Membrane Mounting Tape: Double-sided strip of pressure-sensitive, acrylic adhesive reinforced with embedded fiber-strand carrier layer and plastic backing.

1. Width: 3/4 inch (19 mm).
2. Roll Length: 164 feet (50 m).
3. Thickness: 14 mil, 0.014 inch (0.356 mm).

I. Liquid Flashing: One part, fast curing, non-sag, gun grade, trowelable liquid flashing.

J. Termite-Resistant Barrier Seam and Window Flashing: Peel and stick flashing membrane; polyethylene film bonded to sealant.

1. Thickness: 40 mil, 0.040 inch (1.016 mm) overall.
2. Roll Width: 4 inch (102 mm).
3. Termite Resistance: 100 percent when tested in accordance with ICC-ES AC380.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions are ready to accept the work of this section.

3.02 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

B. Clean and prime substrate surfaces to receive adhesives in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Water-Resistive Barriers: Install continuous barrier over surfaces indicated, with sheets lapped to shed water but with seams not sealed.

C. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

D. Vapor Retarders: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

E. Apply sealants and adhesives within recommended application temperature ranges. Consult manufacturer if temperature is out of this range.

F. Mechanically Fastened Sheets - On Exterior:

1. Install sheets shingle-fashion to shed water, with seams generally horizontal.
2. Overlap seams as recommended by manufacturer but at least 6 inches.
3. Overlap at outside and inside corners as recommended by manufacturer but at least 12 inches (305 mm).
4. Install water-resistive barrier over jamb flashings.
5. Install air barrier and vapor retarder UNDER jamb flashings.
6. Install head flashings under weather barrier.
7. At openings to be filled with frames having nailing flanges, wrap excess sheet into opening; at head, seal sheet over flange and flashing.

G. Mechanically Fastened Sheets - Vapor Retarder On Interior:

1. When insulation is to be installed in assembly, install vapor retarder over insulation.
2. Seal seams, laps, perimeter edges, penetrations, tears, and cuts with self-adhesive tape, making air tight seal.
3. Locate laps at a framing member; at laps fasten one sheet to framing member then tape overlapping sheet to first sheet.
4. Seal entire perimeter to structure, window and door frames, and other penetrations.
5. Where conduit, pipes, wires, ducts, outlet boxes, and other items are installed in insulation cavity, pass vapor retarder sheet behind item but over insulation and maintain air tight seal.

H. Self-Adhered Sheets:

1. Prepare substrate in manner recommended by sheet manufacturer; fill and tape joints in substrate and between dissimilar materials.
2. Lap sheets shingle-fashion to shed water and seal laps air tight.
3. Once sheets are in place, press firmly into substrate with resilient hand roller; ensure that laps are firmly adhered with no gaps or fishmouths.
4. Use same material, or other material approved by sheet manufacturer for the purpose, to seal to adjacent construction and as flashing.
5. At wide joints, provide extra flexible membrane allowing joint movement.

I. Coatings:

1. Prepare substrate in manner recommended by coating manufacturer; treat joints in substrate and between dissimilar materials as recommended by manufacturer.
2. Use flashing to seal to adjacent construction and to bridge joints.

J. Openings and Penetrations in Exterior Weather Barriers:

1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches (125 mm) onto weather barrier and at least 6 inches (150 mm) up jambs; mechanically fasten stretched edges.
2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches (100 mm) wide; do not seal sill flange.
3. At openings to be filled with non-flanged frames, seal weather barrier to each side of opening framing, using flashing at least 9 inches (230 mm) wide, covering entire depth of framing.
4. At head of openings, install flashing under weather barrier extending at least 2 inches (50 mm) beyond face of jambs; seal weather barrier to flashing.
5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Coordination of ABAA Tests and Inspections:

1. Provide testing and inspection required by ABAA QAP.
2. Notify ABAA in writing of schedule for air barrier work, and allow adequate time for testing and inspection.
3. Cooperate with ABAA testing agency.
4. Allow access to air barrier work areas and staging.
5. Do not cover air barrier work until tested, inspected, and accepted.

C. Do not cover installed weather barriers until required inspections have been completed.

D. Obtain approval of installation procedures by the weather barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.

3.05 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

B. Do not leave paper- or felt-based barriers exposed to weather for longer than one week.

END OF SECTION

SECTION 07 4113
METAL ROOF PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Structural roofing system of preformed steel panels.

B. Structural roofing system of preformed aluminum panels.

C. Architectural roofing system of preformed steel panels.

D. Architectural roofing system of preformed aluminum panels.

E. Thermal roof insulation.

F. Attachment system.

G. Finishes.

H. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 05 1200 - Structural Steel Framing: Roof framing and purlins.

B. Section 06 1000 - Rough Carpentry: Roof sheathing.

C. Section 06 1500 - Wood Decking: Roof sheathing.

D. Section 07 2100 - Thermal Insulation: Rigid roof insulation.

E. Section 07 4213 - Metal Wall Panels: Preformed wall panels.

F. Section 07 9200 - Joint Sealants: Sealing joints between metal roof panel system and adjacent construction.

G. Section 09 9113 - Exterior Painting: Field priming and painting roofing panels.

1.03 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2017.

C. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process 2010 (Reapproved 2015).

D. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.

E. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.

F. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.

G. ASTM C1363 - Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus 2011.

H. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing 2017.

I. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection 2017.

J. ASTM D4869/D4869M - Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing 2016a.

K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2018b.

L. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.

M. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings 2017.

N. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference 2005 (Reapproved 2017).

O. ASTM E1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference 1995 (Reapproved 2018).

P. ASTM E1680 - Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems 2016.

Q. IAS AC472 - Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems 2017.

R. ICC-ES AC188 - Acceptance Criteria for Roof Underlayments 2012, with Editorial Revision (2015).

S. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.

1. Show work to be field-fabricated or field-assembled.

C. Selection Samples: For each roofing system specified, submit color chips representing manufacturer's full range of available colors and patterns.

D. Verification Samples: For each roofing system specified, submit samples of minimum size 12 inches (305 mm) square, representing actual roofing metal, thickness, profile, color, and texture.

E. Manufacturer Qualification Statement: Provide documentation showing metal roof panel fabricator is accredited under IAS AC472.

F. Test Reports: Indicate compliance of metal roofing system to specified requirements.

G. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in Owner's name and are registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Provide strippable plastic protection on prefinished roofing panels for removal after installation.

B. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Finish Warranty: Provide manufacturer's special warranty covering failure of factory-applied exterior finish on metal roof panels and agreeing to repair or replace panels that show evidence of finish degradation, including significant fading, chalking, cracking, or peeling within specified warranty period of five years from Date of Substantial Completion.

C. Waterproofing Warranty: Provide manufacturer's warranty for weathertightness of roofing system, including agreement to repair or replace roofing that fails to keep out water within specified warranty period of five years from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 STRUCTURAL METAL ROOF PANELS

A. Structural Metal Roofing: Provide complete roofing assemblies, including roof panels, clips, fasteners, connectors, and miscellaneous accessories, tested for compliance with the following minimum standards:

1. Structural Design Criteria: Provide panel assemblies designed to safely support design loads at support spacing indicated, with deflection not to exceed L/180 of span length(L) when tested in accordance with ASTM E1592.
    a. Dead Loads: Weight of roofing system.
    b. Live Loads: As required by ASCE 7.
2. Overall: Complete weathertight system tested and approved in accordance with ASTM E1592.
3. Wind Uplift: Class 90 wind uplift resistance of UL 580.
4. Air Infiltration: Maximum 0.06 cfm/sq ft (1.1 cubic meters/hr/sq m) at air pressure differential of 6.24 lbf/sq ft (300 Pa), when tested according to ASTM E1680.
5. Water Penetration: No water penetration when tested according to procedures and recommended test pressures of ASTM E1646. Perform test immediately following air infiltration test.
6. Thermal Movement: Design system to accommodate without deformation anticipated thermal movement over ambient temperature range of 100 degrees F (56 degrees C).
7. Thermal Performance: Provide thermal resistance through entire system, R-value (RSI-value) of 15 deg F hr sq ft/BTU; 2 inch thick (2.6 K sq m /W; 50.8 mm thick), when tested in accordance with ASTM C1363.

B. Metal Panels: Factory-formed panels with factory-applied finish.

1. Type: Double skin, factory-assembled with foamed-in-place urethane insulation.
2. Steel Panels:
    a. Zinc-coated SS (structural steel) sheet complying with ASTM A653/A653M; minimum G60 (Z180) galvanizing.
    b. Aluminum-zinc alloy-coated SS (structural steel) sheet complying with ASTM A792/A792M; minimum AZ50 (AZM150) coating.
    c. Steel Thickness: Minimum 24 gage (0.024 inch) (0.61 mm).
3. Aluminum Panels:
    a. Alloy: Aluminum complying with ASTM B209 (ASTM B209M); temper as required for forming.
    b. Thickness: Minimum 20 gage (0.032 inch) (0.8 mm).
4. Texture: Smooth.

5. Length: Maximum possible length to minimize lapped joints.
6. Width: Maximum panel coverage of 16 inches (406 mm).
7. Mill-Finish Steel Panels: Treat with passivating chemical prior to shipment, to inhibit formation of corrosion.

2.02 ARCHITECTURAL METAL ROOF PANELS

A. Architectural Metal Roofing: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.

B. Metal Panels: Factory-formed panels with factory-applied finish.

1. Steel Panels:
   a. Zinc-coated steel complying with ASTM A653/A653M; minimum G60 (Z180) galvanizing.
   b. Aluminum-zinc alloy-coated steel complying with ASTM A792/A792M; minimum AZ50 (AZM150) coating.
   c. Steel Thickness: Minimum 24 gage (0.024 inch) (0.61 mm).
2. Aluminum Panels:
   a. Alloy and Temper: Aluminum complying with ASTM B209 (ASTM B209M); temper as required for forming.
   b. Thickness: Minimum 20 gage (0.032 inch) (0.81 mm).
3. Texture: Smooth.
4. Length: Maximum possible length to minimize lapped joints. Where lapped joints are unavoidable, space laps so that each sheet spans over three or more supports.
5. Width: Maximum panel coverage of 24 inches (610 mm).
6. Mill-Finish Steel Panels: Treat with passivating chemical prior to shipment, to inhibit formation of corrosion.

2.03 ATTACHMENT SYSTEM

A. Concealed System: Provide manufacturer's standard stainless steel or nylon-coated aluminum concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement.

2.04 SECONDARY FRAMING

A. Miscellaneous Secondary Framing: Light gage steel framing incidental to structural supports; fabricated from steel sheet.

B. Framing Material: ASTM A 1011/A 1011M, Designation SS steel sheet.

1. Profile: Manufacturer's standard cee, zee, asymmetrical zee, hat channel, plain channel, single slope eave strut, double slope eave strut and angle.
2. Thickness: 12 gage, 0.1046 inch (2.657 mm).
3. Finish: Galvanized per ASTM A653/A653M, G90.

2.05 FABRICATION

A. Panels: Provide factory or field fabricated panels with applied finish and accessory items, using manufacturer's standard processes as required to achieve specified appearance and performance requirements.

B. Joints: Provide captive gaskets, sealants, or separator strips at panel joints to ensure weathertight seals, eliminate metal-to-metal contact, and minimize noise from panel movements.

2.06 FINISHES

A. Custom Fluoropolymer Coating System: Polyvinylidene fluoride (PVDF) multi-coat thermoplastic fluoropolymer coating system, including minimum 70 percent PVDF color topcoat and minimum total dry film thickness of 0.9 mil (0.023 mm); color and gloss as indicated on drawings.

B. Solar Reflectance Index (SRI): 113.

2.07 ACCESSORIES

A. Miscellaneous Sheet Metal Items: Provide flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps and equipment curbs of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.

B. Rib and Ridge Closures: Provide prefabricated, close-fitting components of steel with corrosion resistant finish or combination steel and closed-cell foam.

C. Sealants:

1. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
2. Concealed Sealant: Non-curing butyl sealant or tape sealant.
3. Seam Sealant: Factory-applied, non-skinning, non-drying type.

D. Thermal Insulation: Provide flexible blanket, rigid or semi-rigid type, faced with white, flexible, non-dusting vapor retarder tested for maximum flame spread index of 50, per ASTM E84; for installation using spacer blocks.

1. Thermal Resistance: Minimum, R-value of 9.4 (RSI of 1.7).

E. Underlayment: Synthetic non-asphaltic sheet, intended by manufacturer for mechanically fastened roofing underlayment without sealed seams.

1. Self Sealability: Passing nail sealability test specified in ASTM D1970/D1970M.
2. Flammability: Minimum of Class A, when tested in accordance with ASTM E108.
3. Low Temperature Flexibility: Passing test specified in ASTM D1970/D1970M.
4. Water Vapor Permeance: Vapor retarder; maximum of 1 perm (57.2 ng/(Pa s sq m)), when tested in accordance with ASTM E96/E96M Procedure A (desiccant method).
5. Performance: Meet or exceed requirements for ASTM D226/D226M, Type II asphalt-saturated organic felt.
6. Liquid Water Transmission: Passes ASTM D4869/D4869M.
7. Functional Temperature Range: Minus 70 degrees F (56.7 C) to 212 degrees F (100 C).
8. Fasteners: As specified by manufacturer and building code qualification report or approval.

F. Underlayment: Self-adhering rubber-modified asphalt sheet complying with ASTM D1970/D1970M; 22 mil (0.55 mm) total thickness; with strippable release film and woven polypropylene sheet top surface.

1. Minimum Requirements: Comply with requirements of ICC-ES AC188 for non-self-adhesive sheet.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation of preformed metal roof panels until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Broom clean wood sheathing prior to installation of roofing system.

B. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to assure that the completed roof will be free of leaks.

C. Coordinate installation of waterproof membrane over roof sheathing with 06 1000.

D. Remove protective film from surface of roof panels immediately prior to installation. Strip film carefully, to avoid damage to prefinished surfaces.

E. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by roof panel manufacturer.

F. Where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

3.03 INSTALLATION

A. Overall: Install roofing system in accordance with approved shop drawings and panel manufacturer's instructions and recommendations, as applicable to specific project conditions. Anchor all components of roofing system securely in place while allowing for thermal and structural movement.

1. Minimize field cutting of panels. Where field cutting is absolutely required, use methods that will not distort panel profiles. Use of torches for field cutting is absolutely prohibited.

B. Accessories: Install all components required for a complete roofing assembly, including flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, equipment curbs, rib closures, ridge closures and similar roof accessory items.

C. Install roofing felt and building paper slip sheet on roof deck before installing preformed metal roof panels. Secure by methods acceptable to roof panel manufacturer, minimizing use of metal fasteners. Apply from eaves to ridge in shingle fashion, overlapping horizontal joints a minimum of 2 inches (50 mm) and side and end laps a minimum of 3 inches (75 mm). Offset seams in building paper and seams in roofing felt.

D. Roof Panels: Install panels in strict accordance with manufacturer's instructions, minimizing transverse joints except at junction with penetrations.

E. Insulation: Install insulation between roof covering and supporting members to present a neat appearance. Fold, staple, and tape seams unless otherwise approved by Architect.

3.04 CLEANING

A. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

3.05 PROTECTION

A. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.

B. Touch-up, repair, or replace damaged roof panels or accessories before Date of Substantial Completion.

END OF SECTION

SECTION 07 4213.19
INSULATED METAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Factory-assembled metal panel system for walls, with trim, related flashings and accessory components.

B. Secondary sub-girt framing system, attached to building structural frame.

1.02 RELATED REQUIREMENTS

A. Section 05 1200 - Structural Steel Framing: Structural steel building frame.

B. Section 07 2100 - Thermal Insulation.

C. Section 07 2500 - Weather Barriers: Separate air barrier and vapor retarder materials.

D. Section 07 4213 - Metal Wall Panels: Field-assembled wall panel system.

E. Section 07 6200 - Sheet Metal Flashing and Trim.

F. Section 13 3419 - Metal Building Systems: Building framing system.

G. Placement of anchors in concrete work for attachment of panel components specified by this section.

1.03 REFERENCE STANDARDS

A. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document) 2015.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2017.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

D. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus 2013.

E. ASTM D1621 - Standard Test Method for Compressive Properties Of Rigid Cellular Plastics 2016.

F. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics 2012.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2018b.

H. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).

I. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.

J. ASTM E413 - Classification for Rating Sound Insulation 2016.

K. FLA (PAD) - Florida Building Code Online - Product Approval Directory Current Edition.

L. FM 4880 - Approval Standard for Class 1 Fire Rating of Building Panels or Interior Finish Materials 2015.

M. FM 4881 - Approval Standard for Class 1 Exterior Wall Systems 2016.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer documentation on tested structural, thermal and fire resistance capabilities of assembled panel.

C. Shop Drawings: Indicate dimensions.

D. Samples: Submit two samples of panel, in size illustrating finish color, sheen, and texture.

E. Design and Performance Data: Indicate panel profile and dimensions.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum three years documented experience.

1.06 MOCK-UP

A. Construct mock-up that includes panels.

B. Demonstrate component assembly including panel and glazing materials, weep drainage system, attachments, anchors, and perimeter sealant.

C. Locate where directed.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.

B. Store pre-finished material off ground with weather protection to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion, including:

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Other Acceptable Manufacturers:

1. All Weather Insulated Panels, a Vicwest company; Flat Wall Panel FL40: www.awipanels.com/#sle.
2. Alply Insulated Panels, LLC; Snug Seam: www.alply.com/#sle.
3. ATAS International, Inc: www.atas.com/#sle.
4. Centria: www.centria.com/#sle.
5. MBCI: www.mbci.com/#sle.
6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PANEL SYSTEM

A. Metal Panel System: Factory-assembled metal panel system, with trim, related flashings and accessory components.

1. Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
2. Accommodate tolerances of building structural framing.
3. Provide continuity of thermal barrier at building enclosure elements.
4. Provide continuity of vapor retarder at building enclosure elements in conjunction with vapor retarders specified in Section 07 2500.
5. Provide continuity of air barrier seal at building enclosure elements in conjunction with air seal materials specified in Section 07 2500.

B. Performance Requirements:

1. Thermal Performance: Provide thermal resistance through entire system.
2. Structural Performance: Design and size to withstand all dead loads and wind loads caused by positive and negative wind pressure acting normal to plane of panel.
    a. Verify structural performance in accordance with ASTM E330/E330M, using test pressure 1.5 times design wind pressure, with 10 seconds duration of maximum load.
3. Fire Resistance: Class 1 fire rated, without height limitation, when tested in accordance with FM 4880.
4. Wind Resistance: Class 1 approval for wall and roof construction, without height limitation, in accordance with FM 4881.
5. Wind-Borne-Debris Resistance: Identical full-size assembly without auxiliary protection, having Florida Building Code approval for Large and Small Missile impact and pressure cycling at design wind pressure.
6. Acoustical Performance: Provide sound attenuation through system (exterior to interior) of STC 38, calculated in accordance with ASTM E413, tested in accordance with ASTM E90.
7. Movement: Accommodate the movement caused by the following without damage to system, components, or deterioration of seals:
    a. Normal movement between system components.
    b. Seasonal temperature cycling.
    c. Deflection of structural support framing,
    d. Shortening of building concrete structural columns.

2.03 PANELS AND TRIM

A. Wall Panels: Exterior and interior metal sheet skin, factory-assembled, with foamed in place insulation; exterior and interior sheet interlocking at edges, fitted with continuous gaskets.
    1. Exterior Sheet: Pre-finished galvanized steel, 22 gage, 0.0299 inch (0.76 mm) minimum base metal thickness; stucco embossed.

B. Soffit Panels: Exterior and interior metal sheet skin, factory-assembled, with foamed in place insulation; exterior and interior sheet interlocking at edges, fitted with continuous gaskets.
    1. Exterior Sheet: Pre-finished galvanized steel, 22 gage, 0.0299 inch (0.76 mm) minimum base metal thickness; stucco embossed.
    2. Interior Sheet: Galvanized steel, pre-finished, 22 gage, 0.0299 inch (0.76 mm) minimum base metal thickness.

C. Internal and External Corners: Same material, thickness, and finish as exterior sheets; factory-fabricated mitered to required angles in one continuous piece with minimum 18 inch (450 mm) returns.

D. Trim, Closure Pieces, Expansion Joints, Caps, Flashings, Fascias and Infills: Same material , thickness and finish as exterior sheets; factory-fabricated to required profiles; fabricated in longest practicable lengths.

2.04 PANEL MATERIALS

A. Precoated Galvanized Steel Sheet: ASTM A653/A653M, Commercial Steel (CS) or Forming Steel (FS), with G90/Z275 coating; continuous-coil-coated with acrylic primer coat, silicone polyester top coat, and polyester washcoat for panel back.

B. Foamed-in-Place Insulation: Urethane type.

1. Thermal Conductivity (k factor): as determined by ASTM C177.
2. Water Vapor Transmission: tested in accordance with ASTM E96/E96M.
3. Water Vapor Absorption: percent by volume as tested in accordance with ASTM D2842.
4. Compressive Strength: tested in accordance with ASTM D1621.
5. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

C. Gaskets: Manufacturer's standard type suitable for use with panel system, permanently resilient; ultraviolet and ozone resistant; color as selected by Architect.

D. Panel Sealants: Manufacturer's standard type suitable for use with installation of panel system; non-staining, skinning, non-shrinking, non-sagging, ultra-violet and ozone resistant; color as selected by Architect.

2.05 ACCESSORIES

A. Concealed Sealants: Non-curing butyl sealant or tape sealant.

B. Exposed Sealants: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.

1. Products:

a. Franklin International, Inc; Titebond WeatherMaster Metal Roof Sealant: www.titebond.com/#sle.

b. Substitutions: See Section 01 6000 - Product Requirements.

C. Fasteners: Manufacturer's standard type to suit application; hot-dip galvanized steel with soft neoprene washers. Fastener cap same color as exterior panel.

D. Field Touch-up Paint: As recommended by panel manufacturer.

E. Bituminous Paint: Asphalt base.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that structural framing is ready to receive panel system.

3.02 INSTALLATION

A. Install panel system on walls and soffits in accordance with manufacturer's instructions.

B. Protect panel surfaces in contact with cementitious materials with bituminous paint. Allow to dry prior to installation.

C. Permanently fasten panel system to structural supports; aligned, level, and plumb, within specified tolerances.

D. Locate panel joints over supports.

E. Use concealed fasteners unless otherwise approved by Architect .

F. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

3.03 TOLERANCES

A. Maximum Offset From True Alignment Between Adjacent Members Butting or In Line: 1/16 inch (1.6 mm).

3.04 CLEANING

A. Remove site cuttings from finish surfaces.

B. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

C. Upon completion of installation, thoroughly clean prefinished aluminum surfaces in accordance with AAMA 609 & 610.

END OF SECTION

SECTION 07 5050
VEGETATED ROOF COMPONENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vegetated roof components that occur above waterproof membrane, including:

1. Pre-planted, garden roof trays and accessories ("modular extensive").
2. Vegetated roofing system with less than 6 inches (152 mm) of soil/growth medium ("extensive").
3. OR Vegetated roofing system with 6 inches (152 mm) or more of soil/growth medium ("intensive").
4. Roof pavers systems.
5. Plants.

1.02 RELATED REQUIREMENTS

A. Section 07 1400 - Fluid Applied Waterproofing: Fluid-applied waterproofing for deck below vegetated roof.

B. Section 07 5200 - Modified Bituminous Membrane Roofing: Below vegetated roof using modular trays.

C. Section 07 5400 - Thermoplastic Membrane Roofing: Single-ply roofing over deck below vegetated roof.

1.03 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN m/m3)) 2012, with Editorial Revision (2015).

C. ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics 2016.

D. ASTM E303 - Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester 1993 (Reapproved 2013).

E. SPRI RP-4 - Wind Design Standard for Ballasted Single-Ply Roofing Systems 2013.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product data on components of vegetated roof.

C. Shop Drawings: Indicate size and outline of roof, location and type of materials, and details of accessories and edge treatments.

D. Manufacturer Certification: Submit written approval by membrane manufacturer of the proposed vegetated roof assembly and its components.

E. Manufacturer's Instructions: Submit copies of manufacturer's written installation instructions and other recommendations.

F. Preinstallation Field Report: Provide documentation that membrane installation has been approved by manufacturer and has passed specified testing.

G. Manufacturer's Qualification Statement.

H. Installer's Qualification Statement.

I. Project Record Documents: Record actual locations of planted areas, hardscape features, existing concealed drains, and irrigation system (if provided).

J. Maintenance Data: Submit manufacturer recommendations for maintenance of materials and plants.

K. Warranty Documentation:

1. Submit manufacturer warranty and ensure that forms have been completed in Owner 's name and registered with manufacturer.

2. Submit installer's certification that installation complies with warranty conditions for waterproof membrane.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing the work specified in this section, with not less than three years of documented experience.

C. Single Source Responsibility: Provide and install products from single source.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in original, unopened containers or wrappings.

B. Store materials under cover and elevated above grade.

C. Store roll material lying down and on pallets fully protected from moisture.

D. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

E. Remove damaged materials from job site, and replace damaged materials.

1.07 FIELD CONDITIONS

A. Ambient Conditions: Install garden roof between April 1st and October 15th, unless otherwise indicated, or recommended in writing by manufacturer.

B. Roof Slope: Do not install vegetated roofing over substrate with slope of less than 2 percent.

C. Existing Conditions: Obtain written certification from the Architect or Owner that structure can safely withstand additional load imposed by soil and plant overburden.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a one year period after Date of Substantial Completion.

C. Provide manufacturer's twenty year, single-source "full system" warranty.

PART 2 PRODUCTS

2.01 VEGETATED ROOFING USING MODULAR ROOF TRAYS

A. Vegetated Roofing Assembly: Modular trays and protective layers installed over waterproofing or membrane roofing system.

1. Protection Layers (in Order from Bottom Up): Provided and approved by waterproofing or membrane manufacturer:

a. Protection layer.

b. Cover board.

2. Number of protective materials may be reduced provided equivalent protection and functionality is achieved and is approved by waterproofing or membrane manufacturer.

3. Acceptable Roofing Manufacturers:
    a. Firestone Building Products Company: www.firestonebpco.com/#sle.
    b. Soprema: www.soprema.us/#sle.
    c. Substitutions: See Section 01 6000 - Product Requirements.

B. Trays: Pre-planted, modular, plastic garden roof trays, with integral drainage/filter fabric and manufacturer's standard growth medium.
1. Plants: Drought-resistant mix of grasses, perennials and groundcovers suitable to a non-irrigated or minimally-irrigated installation.
2. Size: Provide manufacturer's standard size trays as indicated on drawings. Single-tray size not to exceed 8 square feet (0.74 sq m).
3. Depth and Weight: 4 inches (101 mm) (nominal) deep and weighing no more than 18 pounds per square foot (88 kg per sq m) fully saturated.
4. Irrigation System: Black polystyrene drip irrigation and flow control emitters pre-installed with attachment for exterior hose bibb or other water supply; provide 50 feet (15.25 m) of extra tubing.
5. Manufacturers:
    a. Any manufacturer approved by membrane roofing or waterproofing manufacturer.

2.02 VEGETATED ROOFING OVER SINGLE-PLY MEMBRANE ROOFING

A. Membrane Roofing System: Specified in Section 07 5400.

B. Vegetated Roofing Assembly: Provide less than 6 inches (less than 152 mm) of growth medium, drainage layers and protection layers installed over mechanically-fastened single-ply membrane roofing.
1. Protection Layers (in Order from Bottom Up): Provided by, or approved by, membrane manufacturer.
    a. Protection fabric.
    b. Horizontal drain board.
2. Type and number of protective materials may be reduced provided equivalent protection and functionality is achieved and is approved by manufacturer.

C. Protection Fabric: 6 ounce per square yard (34 g per sq m), minimum, and 0.120 inch (3 mm) thick, needle-punched polyester fabric.

D. Horizontal Drain Board: 0.25 inch (6.35 mm) thick, minimum, with 10,800 pounds per square foot (517 kPa) minimum compressive strength and molded polystyrene core-only configuration specifically designed for horizontal application.

2.03 VEGETATED ROOFING OVER WATERPROOFING

A. Waterproofing System: Specified in Section 07 1400.

B. Vegetated Roofing Assembly: 6 inches or more (152 mm or more) of growth medium and protective layers installed over fluid-applied waterproofing membrane with additional insulation above membrane.
1. Protection Layers (in Order from Bottom Up):
    a. Protection board.
    b. Root barrier.
    c. Drain board.

2. Number and type of protective materials may be reduced provided equivalent protection and functionality is achieved and is approved by manufacturer.
3. Vegetated Waterproofing Manufacturers:
    a. American Hydrotech, Inc; 6125EV: www.hydrotechusa.com/#sle.
    b. Carlisle Coatings and Waterproofing, Inc: www.carlisleccw.com/#sle.
    c. Henry Company; 790-11 (as part of Henry's Vegetative Roof Assembly - VRA): www.henry.com/#sle.
    d. Substitutions: Section 01 6000 - Product Requirements.

C. Protection Layer Materials: Membrane manufacturer's recommended types.

D. Protection Board: 0.090 inch (2.8 mm) minimum thickness, glass-fiber, modified-bitumen mat with SBS rubber and asphalt blend.

2.04 FIELD-INSTALLED SOIL/GROWTH MEDIUM

A. Provide manufacturer's custom growing media mix capable of supporting vigorous growth of specified vegetation.

2.05 FIELD-INSTALLED PLANTS

A. See drawings for plants required.

2.06 ROOF PAVERS SYSTEMS

A. Precast Concrete Roof Pavers: Precast concrete tiles, with texture and color as indicated; supported by adjustable pedestal system.
1. Comply with local wind load resistance requirements of ASCE 7.
2. Texture: As selected by Architect from manufacturer's standard line.
3. Slip Resistance: Provide walking surfaces of exterior pavers with pendulum test values of at least 40 in accordance with ASTM E303 test method.

B. Paver Pedestals: Adjustable stand of multiple high impact copolymer polypropylene components to level and adjust height of pavers using 4-3/16 inch (107 mm) diameter SDR-35 PVC pipe, with maximum static load of 2,000 lbs (907 kgs) per pedestal.
1. Comply with local wind load resistance requirements of ASCE 7.
2. Self-Ignition Temperature: Provide plastic pedestal components with self-ignition temperature greater than 650 degrees F (343 degrees C) in accordance with ASTM D1929 test method.
3. Pedestal Height: Within 1/2 inch (12.7 mm) to 2-1/4 inch (57 mm), without use of PVC pipe in pedestal system.
4. Pedestal Height: Within 2-1/4 inch (57 mm) to 36 inch (914 mm), with use of PVC pipe in pedestal system.

2.07 ACCESSORIES

A. Stone Ballast: No.4 size, 1-1/2 inch (38.1 mm) nominal diameter, rounded, water-worn gravel complying with ASTM D448 and applied at a minimum of 10 pounds per square foot (0.48 kPa).

B. Paver Edge Restraints: Provide closure to underside of pavers at perimeter edge of pavers or areas that change elevation or step-down; restraint system shall fully contain pavers and tie back into building wall or parapet.

C. Edge Treatment: Provide dividers and edge elements to separate vegetated portion of roof from other areas as indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that waterproof membrane work is complete.

B. Verify that surface of membrane is ready to accept vegetated roofing components.

C. Inspections and Testing Prior to Installation of Vegetated Roof Components:

1. Verify that installed waterproofing or membrane roofing system has been inspected by manufacturer's representative.

2. Verify that installed waterproofing or membrane roofing system has been tested by controlled flooding, electronic testing or other leak detection method approved by manufacturer.

3. Provide documentation that membrane installation has been approved by manufacturer and passed specified testing.

3.02 PREPARATION

A. Clean membrane surfaces of ponded water, snow, ice, dirt, debris, and foreign materials.

3.03 INSTALLATION, GENERAL

A. Install in accordance with membrane manufacturer's instructions and warranty restrictions, if any.

B. Dry surfaces thoroughly before vegetated roofing work begins.

C. Protect waterproofing or roof membrane as necessary to prevent damage during application of vegetated roof system.

D. Provide temporary ballast in partially completed sections of vegetated roof to protect overburden from wind effects during installation; ensure ballast has no sharp edges, protrusions, chemical contaminants, or other composition that could damage waterproof membrane.

3.04 PROTECTION BOARD OVER WATERPROOFING INSTALLATION

A. Embed protection board in fluid-waterproofing while waterproofing is still hot and overlap edges 2 to 3 inches (51 to 76 mm).

B. Seal laps with additional fluid waterproofing.

3.05 DRAIN BOARDS INSTALLATION

A. Horizontal Surfaces: Install boards by method required or recommended by membrane manufacturer.

1. Loose Laid Boards: Loose-lay drain boards; abut square edges tightly together; overlap flanged edges for tight fit with flange at highest end of board (away from drains); secure panels if high winds are predicted before placement of soil/growth media and plants.

B. Vertical Surfaces: Fasten to substrate in accordance with manufacturer's recommendations.

C. Corners:

1. Bend panels to make inside corners.

2. Cut panel flush with corner but leave 3 inches (76 mm) of additional fabric, and wrap fabric around edge of drain board and secure with tape to back of board, as required.

D. Penetrations: Cut drain board to fit tightly around penetrations.

E. Inspect completed drain board installation, and repair holes and tears by lapping each hole or tear at least 6 inches (152 mm) with new, undamaged filter fabric and sealing with manufacturer-approved tape.

3.06 INSULATION INSTALLATION

A. Handle insulation carefully, and avoid damaging or rupturing facer or finished surface.

B. Install insulation with staggered end joints.

C. Abut edges tightly together.

D. Inspect completed insulation installation; cut out broken corners or other damaged areas of insulation, and replace with undamaged insulation custom cut to fit damaged or broken area removed.

3.07 PROTECTION FABRIC INSTALLATION

A. Unroll protection fabric and draw tight without folds or wrinkles.

B. Overlap adjacent sheets [6 inches] ([152 mm]), and fasten edges with hot-air welding or with manufacturer's recommended construction adhesive.

C. Attach protection fabric to substrate, as required, with manufacturer's recommended construction adhesive.

D. Extend protection fabric on vertical surfaces to a point at least 2 inch (51 mm) above top of overburden.

E. Inspect completed protection fabric installation; repair any holes or tears by lapping each hole or tear at least 6 inches (152 mm) with new, undamaged protection fabric and sealing with manufacturer-approved tape.

3.08 PROTECTION FABRIC/WATER RETENTION MAT INSTALLATION

A. Loose-lay protection fabric/water retention mat, draw tight without folds or wrinkles, and overlap edges 3 inches (76 mm).

B. Temporarily attach protection fabric to substrate during installation, as required, with manufacturer's recommended construction adhesive.

C. Inspect completed protection fabric/water retention mat installation; repair any holes or tears by lapping each hole or tear at least 6 inches (152 mm) with new, undamaged material and sealing with manufacturer-approved tape.

3.09 PAVERS AND ACCESSORIES INSTALLATION

A. Edge Treatment: Install dividers and edging where indicated.

1. Provide intermittent spacing between dividers to allow water to flow between areas.

2. Extend protection layers up vertical surfaces of dividers and edging to retain overburden.

B. Install pavers on pedestals, fully support each edge, and shim and/or adjust pavers to provide level surface.

C. Paver Edge Restraints: Install exposed paver edge restraints in accordance with roof paver manufacturer's instructions.

D. Ballast: Install ballast in accordance with SPRI RP-4.

3.10 SOIL/GROWTH MEDIUM INSTALLATION

A. General: Place soil/growth medium carefully to avoid damaging or displacing other materials and accessories.

B. Placement, Depth Greater than 8 inches (203 mm):

1. Place soil/growth medium in lifts of 6 inches (152 mm) or less, except final lift.

2. Compact each lift as described below.
3. Place final lift of 6 inches (152 mm) or less and 1 inch (25 mm) greater than proposed finish grade prior to compaction.
4. Compact final lift until top of soil is within 1 inch (25 mm) of proposed finish grade.

C. Placement, Soil Depth Less than 8 inches (203 mm):

1. Place soil/growth medium in single lift of 8 inches (203 mm) or less and to 1 inch (25 mm) greater than proposed finish grade.
2. Compact lift until top of soil is within 1 inch (25 mm) of proposed finish grade

D. Compaction:

1. Use landscape rollers or handheld mechanical compactors.
2. Compact soil/growth medium to between 50 and 60 percent compaction as measured by ASTM D1557.

E. Install and maintain erosion control devices as recommended by manufacturer until plant installation is complete.

3.11 PLANTS INSTALLATION

A. Install plants in accordance with good horticultural practice.

B. Maintain plants in a live and healthy condition until Date of Substantial Completion.

3.12 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Have completed garden roof inspected by manufacturer's field representative.

C. Obtain waterproof membrane manufacturer's written approval of completed garden roof installation.

3.13 CLEANING

A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

B. In areas where finished surfaces are soiled by work of this section, consult manufacturers of surfaces for cleaning advice and comply with their documented instructions.

C. Repair or replace defaced or damaged finishes caused by work of this section.

3.14 PROTECTION

A. Protect installed vegetated roof system from construction traffic and subsequent construction operations.

B. Provide substantial barricades or other barriers where necessary to prevent traffic across vegetation.

3.15 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Maintain plants in vegetated roof for a period of one year after Date of Substantial Completion.

C. Provide a separate maintenance contract for specified maintenance service.

END OF SECTION

SECTION 07 5100
BUILT-UP BITUMINOUS ROOFING

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 05 3100 - Steel Decking: Product requirements for acoustical insulation for deck flutes, for placement by this section.

B. Section 06 1000 - Rough Carpentry: Wood nailers and curbs.

C. Section 07 0150.19 - Preparation for Re-Roofing.

D. Section 07 6200 - Sheet Metal Flashing and Trim: Counterflashings, reglets.

E. Section 07 7100 - Roof Specialties: Prefabricated roofing expansion joint flashing.

F. Section 07 7200 - Roof Accessories: Roof-mounted units.

G. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 REFERENCE STANDARDS

A. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board 2012.

B. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation 2017, with Editorial Revision (2018).

C. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation 2018.

D. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board 2018a.

E. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.

F. ASTM D41/D41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing 2011 (Reapproved 2016).

G. ASTM D312/D312M - Standard Specification for Asphalt Used in Roofing 2016a.

H. ASTM D1863/D1863M - Standard Specification for Mineral Aggregate Used on Built-Up Roofs 2005, with Editorial Revision (2012).

I. ASTM D2178/D2178M - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing 2015a.

J. ASTM D3909/D3909M - Standard Specification for Asphalt Roll Roofing (Glass Felt) Surfaced with Mineral Granules 2014.

K. ASTM D4897/D4897M - Standard Specification for Asphalt-Coated Glass-Fiber Venting Base Sheet Used in Roofing 2016.

L. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces 2011.

M. FM (AG) - FM Approval Guide current edition.

N. NRCA (RM) - The NRCA Roofing Manual 2018.

O. UL (FRD) - Fire Resistance Directory Current Edition.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating membrane and bitumen materials, base flashing materials, insulation, vapor retarder and surfacing.

1. Sustainable Design Submittal: Include test documentation of solar reflectance and thermal emissivity of membrane, and calculation of solar reflectance index (SRI).

C. Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials and setting plan for tapered insulation.

D. Samples for Verification: Submit two samples illustrating insulation and colored coating.

E. Samples of Pavers: Submit walkway pads or rolls of color required.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

G. Manufacturer's Field Reports: Indicate procedures followed, ambient temperatures, humidity and supplementary instructions given.

H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner 's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact.

B. Store materials in weather protected environment, clear of ground and moisture.

C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

D. Protect foam insulation from direct exposure to sunlight.

1.06 FIELD CONDITIONS

A. Do not apply roofing membrane during unsuitable weather.

B. Do not apply roofing membrane when ambient temperature is below 40 degrees F (5 degrees C).

C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

E. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within the warranty year period after Date of Substantial Completion.

C. Provide 20 year manufacturer's material and labor warranty to cover failure to prevent penetration of water.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Sheet and Bitumen Materials:
   1. GAF: www.gaf.com/#sle.
   2. Johns Manville: www.jm.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Insulation:
   1. Blue Ridge Fiberboard: www.blueridgefiberboard.com/#sle.
   2. Dow Chemical Company: www.dow.com/#sle.
   3. ROCKWOOL (ROXUL, Inc): www.rockwool.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

C. Source Limitations: Obtain components including roof insulation fasteners for built-up roofing from same manufacturer as built-up roofing or manufacturer approved by built-up roofing manufacturer.

2.02 ROOFING - CONVENTIONAL APPLICATION

A. Built-up Bituminous Roofing: Asphalt felt membrane, four ply plus base sheet, with vapor retarder and insulation.

B. Roofing Assembly Performance Requirements:
   1. Solar Reflectance Index (SRI): 78, minimum, calculated in accordance with ASTM E1980, based on 3-year aged data.
      a. Field applied coating may not be used to achieve specified SRI.
   2. Roof-Ceiling Fire Resistance Rating: Comply with FM (AG) Assembly Design.
   3. Roof Covering External Fire Resistance Classification: UL (FRD) Class A.
   4. Insulation Thermal Resistance (R-Value): 3 per inch, minimum; provide insulation of thickness required.

C. Acceptable Insulation Types: Any type that meets requirements and is approved by membrane manufacturer for application.
   1. Minimum 2 layers of composite board.
   2. Bottom layer of polyisocyanurate board covered with single layer of cellulose or extruded polystyrene board.

D. Acceptable Insulation Types - Tapered Application: Any of the types specified.

E. Surfacing: Aggregate, as indicated on drawings.

2.03 SHEET MATERIALS

A. Vapor Retarder Felt: Asphalt-saturated organic, ASTM D226/D226M Type I ("No.15") felt, unperforated.

B. Base Sheet: Asphalt-saturated and -coated, venting glass fiber felt; ASTM D4897/D4897M Type II, heavy-duty.

C. Roofing Felt: ASTM D2178/D2178M Asphalt-saturated glass fiber felt; standard duty.

D. White Cap Sheet: Asphalt-saturated glass fiber roll roofing surfaced with flexible acrylic coating and ceramic granules; complying with ASTM D3909/D3909M.
   1. Solar Reflectance: 0.75, minimum, initial, and 0.60, minimum, 3-year aged, certified by Cool Roof Rating Council.

2. Thermal Emissivity: 0.80, minimum, initial, and 0.85, minimum, 3-year aged, certified by Cool Roof Rating Council.
3. Manufacturers:
    a. CertainTeed Corporation; Flintglas MS Cap CoolStar: www.certainteed.com/#sle.
    b. GAF: www.gaf.com/#sle.
    c. Johns Manville: www.jm.com/#sle.
    d. Substitutions: See Section 01 6000 - Product Requirements.

E. Base Flashing Material: Granule Surfaced Flashing Sheet.
1. Elasticity: 50 percent with full recovery without set.
2. Color: White.

F. Flexible Flashing Material: Modified bitumen, SBS type.
1. Tensile Strength: 1,200 psi (8.3 MPa).
2. Elasticity: 50 percent with full recovery without set.
3. Color: White.

G. Separation Sheet: Sheet polyethylene; 2 mil (0.05 mm) thick.

H. Water Pervious Fabric: Woven polyethylene, UV stabilized, open to moisture movement, black.

2.04 BITUMINOUS MATERIALS

A. Bitumen: ASTM D312/D312M Type I, asphalt.

B. Primer: ASTM D41/D41M, asphalt type.

C. Roof Cement: ASTM D4586/D4586M, Type I, asbestos free.

2.05 DECK SHEATHING AND COVER BOARDS

A. Deck Sheathing: Gypsum sheathing, ASTM C1396/C1396M, Type X special fire resistant type, paper face, 5/8 inch (16 mm) thick.

B. Cover Boards: Coated cellulosic fiberboard, complying with ASTM C208.
1. Manufacturers:
    a. Blue Ridge Fiberboard; STRUCTODEK HD with Primed Red Coating: www.blueridgefiberboard.com/#sle.
2. Substitutions: See Section 01 6000 - Product Requirements.

2.06 INSULATION

A. Cellulose Fiber Board Insulation: ASTM C208 Type II, both faces finished with mineral fiber, asphalt and kraft paper.
1. Board Size: 48 by 96 inch (1219 by 2438 mm).
2. Board Thickness: 1/2 inch (13 mm).
3. Board Edges: Square.
4. Thermal Conductivity (k-value): 0.38 Btu in/hr sq ft degrees F (0.055 W/m K) at 75 degrees F (24 degrees C).

B. Extruded Polystyrene (XPS) Board Insulation: Complies with ASTM C578 with natural skin surfaces, with drainage channels on one face.

C. Composite Board Insulation: Top layer high-density wood fiberboard (HDF), bottom layer polyisocyanurate, with polyisocyanurate complying with ASTM C1289.

1. Polyisocyanurate surfaces faced with aluminum foil.
2. Board Size: 48 by 96 inch (1220 by 2440 mm).
3. Board Thickness: 1.5 inch (37.5 mm).
4. Tapered Board: Slope as indicated; minimum thickness as shown on plans; fabricate of fewest layers possible.

D. Cellular Glass Board Insulation: Complying with ASTM C552, Type IV.

1. Board Size: 48 inches long by 24 inch wide (1219 mm long by 610 mm wide) .
2. Board Thickness: 1-1/2 inch (38 mm).
3. Apparent Thermal Conductivity: K (Ksi) value of 0.31 Btu inch/hr sq ft degrees F (0.045 W/m K) at 75 degrees F (24 degrees C) mean temperature.

2.07 SURFACING MATERIALS - CONVENTIONAL APPLICATION

A. Aggregate: ASTM D1863/D1863M sound, hard washed river gravel; 1/4 inch (6 mm) minimum to 1/2 inch (12 mm) maximum size.

B. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.

1. Composition: Asphaltic with mineral granule surface.
2. Surface Color: White or yellow.
3. Manufacturers:
   a. W. R. Meadows, Inc; Whitewalk: www.wrmeadows.com/#sle.
   b. Substitutions: See Section 01 6000 - Product Requirements.

2.08 ACCESSORIES

A. Prefabricated Roofing Expansion Joint Flashing: As specified in Section 07 7100.

B. Cant and Edge Strips: Bitumen-impregnated wood fiberboard, compatible with roofing materials ; cants formed to 45 degree angle, tapered edge strips and other configurations as detailed.

C. Insulation Joint Tape: Glass fiber reinforced type as recommended by insulation manufacturer, compatible with roofing materials; 6 inches (150 mm) wide; self adhering.

D. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.

1. Length as required for thickness of insulation material and penetration of deck substrate, with metal washers.

E. Roofing Nails: Galvanized, hot dipped type, size and configuration as required to suit application.

F. Roof Insulation Vents: Aluminum , with perforated inner tube; protective cap and mounting flange.

G. Strip Reglet Devices: Galvanized steel, maximum possible lengths per location, with attachment flanges.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify deck is supported and secure.

C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.

D. Verify deck surfaces are dry and free of snow or ice.

E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.02 WOOD DECK PREPARATION

A. Verify flatness and tightness of joints of wood decking. Fill knot holes with latex filler.

B. Confirm dry deck by moisture meter with 12 percent moisture maximum.

C. Conventional Application: Apply mopped two-ply vapor retarder; nail along ply laps at 12 inches (300 mm) on center.

D. Protected Membrane Application: Extend two plies of felt from 12 inches (300 mm) around roof perimeter to roof edge and onto wall air seal material with lap; seal air tight.

E. Protected Membrane Application: Mop cant strips in place with hot bitumen.

3.03 CONCRETE DECK PREPARATION

A. Fill surface honeycomb and variations with latex filler.

B. Confirm dry deck by moisture meter with 12 percent moisture maximum.

3.04 METAL DECK PREPARATION

A. Install deck sheathing on metal deck:

1. Lay with long side at right angle to flutes; stagger end joints; provide support at ends.
2. Cut sheathing cleanly and accurately at roof breaks and protrusions to provide smooth surface.
3. Tape joints.

B. Conventional Application: Apply fire resistant vapor retarder.

3.05 VAPOR RETARDER INSTALLATION - CONVENTIONAL APPLICATION

A. Mopped Two-Ply Vapor Retarder:

1. Apply primer at a rate of 1.0 gal/square (100 sq ft) (3.8 L/square (9.3 sq m)) and allow to dry.
2. Mop surface with hot bitumen and embed two plies of vapor retarder felt; lap plies 19 inches (480 mm), full mop each ply.
3. Apply bitumen at 20 lbs/square (100 sq ft) (9 kgs/square (9.3 sq m)).
4. Glaze top surface of the vapor retarder with bitumen if insulation is not placed immediately.

B. Extend vapor retarder under cant strips and blocking.

3.06 MEMBRANE APPLICATION

A. Install built-up bituminous roofing system in accordance with manufacturers recommendations and NRCA (RM) applicable requirements.

B. Equiviscous Temperature (EVT) at Point of Application: Comply with NRCA (RM) recommendations.

C. Apply membrane plies, weather lap edges and ends, and mop with 20 lbs/square (100 sq ft) (9 kgs/square (9.3 sq m)) of bitumen per ply. Apply plies 2 on 2 in same direction.

D. Apply smooth, free from air pockets, wrinkles, fish-mouths, or tears.

E. At end of day's operation, install two plies membrane and bitumen glaze coat for cut-off. Glaze exposed felts. Remove cut-off before resuming roofing.

F. At intersections with vertical surfaces:

1. Extend membrane and base sheet over cant strips and up a minimum of 4 inches (100 mm) onto vertical surfaces.

2. Mop on base flashing of two additional plies of felt and one ply of base flashing material.

G. Around roof penetrations, mop in and seal flanges and flashings with two additional plies of felt.

H. Install one roof vent per 1,000 sq ft (93 sq m) or part thereof, of roof area.

I. Install roofing expansion joints where indicated. Make joints watertight.

J. Coordinate installation of roof drains and related flashings.

3.07 AGGREGATE SURFACING - CONVENTIONAL APPLICATION

A. Apply uniform flood coat of bitumen at rate of 60 lbs/square (100 sq ft) (27.2 kgs/square (9.3 sq m)).

B. While flood coat is hot, embed aggregate at rate of 400 lbs/square (100 sq ft) (181 kgs/square (9.3 sq m)).

C. Evenly distribute aggregate and ensure bond with flood coat. Extend aggregate to bottom edge of cant strips.

3.08 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field quality control and inspection.

B. Field testing will be performed to:

1. Ascertain bitumen quantities placed.

2. Take and evaluate test cuts of installed membrane.

C. Require site attendance of roofing and insulation material manufacturers daily during installation of the Work.

3.09 CLEANING

A. Remove bituminous markings from finished surfaces.

B. In areas where finished surfaces are soiled by bitumen or other source of soiling caused by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.

C. Repair or replace defaced or damaged finishes caused by work of this section.

3.10 PROTECTION

A. Protect installed roofing and flashings from construction operations.

B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

SECTION 07 5113
BUILT UP ASPHALT ROOFING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specifications apply to this Section.

B. State of Maryland Department of General Services Office of Facilities Planning, Design and Construction Project Management and Design Division - Procedure Manual for Professional Services Roofing Standards July 2015 VII-8

1.02 SUMMARY

A. This Section Includes:

1. Gravel surfaced, asphalt and glass-fiber felt roofing membrane.
2. Roof insulation.
3. Roof drain and drain line installation.
4. Roof Drain flashings.
5. Wood nailers and curbs.
6. Roof hatches.
7. Deck repair
8. Roof Walkways

B. Related Sections: The Following Sections contain requirements related to this Section:

1. Division 2 “Selective Demolition” for demolition of existing roofing membrane and appurtenances.
2. Division 7 Section 07600 “Flashing and Sheet Metal” for metal counterflashings, through-wall Flashings, expansion joints, and other associated flashings.

1.03 DEFINITIONS

A. Thermal resistivity (r-value) is the reciprocal of thermal conductivity (k-value) which is the rate of heat flow through a homogenous material exactly 1 inch thick. Thermal resistivity (r-value) is expressed by the temperature difference in degrees F between two parallel surfaces required to cause 1 Btu to flow through 1 sq. ft. of a homogenous material exactly 1 inch thick per hour at the mean temperature indicated.

1.04 SUBMITTALS

A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.

B. Submit a letter from the roofing system manufacturer stating that the Contractor is a certified applicator and that the roofing system manufacturer has reviewed the Construction Documents and will warranty the proposed roofing system if construction proceeds in accordance with the Drawings and Specifications.

C. Product data, including manufacturer’s technical product information, installation instructions, and recommendations for each type of roofing product required. Include data substantiating that materials comply with requirements.

1. For asphalt bitumen, provide a label on each container or certification with each load of bulk bitumen, indicating flash point (FP), softening point (SP), and equiviscuous temperature (EVT).

D. Three copies of tapered insulation and cricket Shop Drawings indicating drainage pattern to provide positive slope to roof drains, scuppers or gutters. Field verify dimensions, scupper locations and swales built into this roof deck prior to submitting information to the insulation manufacturer to obtain shop drawings.

E. Manufacturer's Certification indicating that all bulk bituminous materials delivered to Project comply with required Standards. Include quantity and statistical and descriptive data for each product. Submit certificate with each load before it is used.

1. Include continuous log showing time and temperature for each load of bulk bitumen, indicating date obtained from the manufacturer, where held, and how transported prior to final heating and application on roof.

F. Field Bitumen Heating Reports: Provide and use two calibrated thermometers, 0-500 degrees F, one on the tanker and one on the roof at all times. Also, provide one 24 hour or one 8 day recording tanker thermometer, 0- 600 degrees F, calibrated at 350 degrees F. Submit dated recording sheets to PGCPS Contract Representative weekly.

G. Letter and Shop Drawing from the roof membrane manufacturer stating fastener pull-out test results are acceptable and indicating the base sheet lapping requirements, fastener spacing requirements and insulation thickness requirements for compliance with FM uplift Classification I-120.

H. Work Schedule. Prior to starting roof work, submit a complete schedule indicating start and completion dates. Every Monday morning, submit (via email or fax to the Owner's Representative and the Engineer) indicating the location of roofing work scheduled for the subsequent six days.

I. Photographs of existing conditions of structure surfaces, equipment, and adjacent improvements that might be misconstrued as damage related to roofing operations. File with PGCPS Contract Representative prior to start of work.

J. Sampling and Analysis of Built-Up Roof Membrane: provide sampling and analysis of completed built-up roofing membrane in accordance with ASTM D 3617-83. Submit laboratory test results from an independent testing firm.

1. Provide for two, 12 inch x 12 inch text cuts at locations designated by the Architect or PGCPS Contract Representative. Repair test cuts in accordance with manufacturer's recommendations.

2. Where deficiencies are indicated in membrane, make corrective repairs as specified by manufacturer. Additional retesting and testing to determine extent of deficient areas shall be completed at the Contractor's expense.

K. Submit executed copy of manufacturer's written Warranty within 30 days of Substantial Completion. Final Payment will not be released without the submission of executed manufacturer's warranty to Owner.

L. Submit a copy of the written reports, provided by an independent consultant, indicating the results from the thermographic inspections of all roofing insulation. Provide copies of additional reports until wet or missing insulation is replaced.

M. Copy of State licenses for mechanics who perform electrical or mechanical work.

N. Submit, during execution of contract, a plan showing quantity and location of all work performed on a unit price basis.

O. Submit letter to the PGCPS Contract Representative stating date of substantial completion within 24 hours after substantial completion.

P. Submit letter to the PGCPS Contract Representative stating date of final completion within 24 hours after final completion

1.05 QUALITY ASSURANCE

A. General: Install replacement roofing in accordance with the manufacturer's specifications and details. More stringent requirements of this Section and Drawings shall govern unless they conflict with the manufacturer's warranty requirements. In this case, the Contractor is responsible for notifying the Engineer of all such conflicts.

B. Installer qualifications: Engage an experienced installer (Roofer) to perform built-up asphalt roofing work who has specialized in installing built-up asphalt roofing systems similar to that required for this Project and who is acceptable to manufacturer of primary roofing materials.

   1. Installer Certification: Obtain written certification from manufacturer of built-up roofing system certifying that Installer is approved by manufacturer to install specified roofing system. Provide copy of certification for the PGCPS Contract Representative prior to beginning work.

   2. Installer's Field Supervision: Require Installer to maintain a full-time supervisor foreman who is fluent in English and on job site at all times. The Foreman shall be experienced in installing roofing systems similar to type and scope required for this Project.

C. Manufacturer Qualifications: Obtain primary products, including each type of roofing felt, bitumen and composition flashings from a single manufacturer. Provide secondary products as recommended by Manufacturer of primary products to use with roofing system specified.

D. Insurance and Code Requirements: Provide built-up roofing system and component materials complying with governing regulations that have been tested for application and slopes indicated and can be installed to comply with the following.

   1. Factory Mutual requirements for Class I or Noncombustible, including zoned wind resistance.

   2. Underwriter's Laboratories for Class A external fire exposure.

E. Insurance Certification: Assist Owner in preparing and submitting roof installation acceptance certification as necessary in connection with fire and extended-coverage insurance on roofing and associated work.

F. Fire Performance Characteristics: Provide insulation materials that are identical to materials whose fire performance characteristics per requirements listed in Part 2 of this Section, have been determined from tests by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

G. Preconstruction Roofing Conference: Approximately 2 weeks prior to scheduled commencement of built-up roofing installation and associated work, meet at the Project site with installer, Installer of each component of associated work, Engineer and Owner's Representative.

H. Thermographic Inspection of insulation: After work is complete, perform a thermographic inspection. Retain an independent firm to perform a thermographic inspection. Retain an independent firm to perform a thermographic inspection of all roofing insulation and provide a written report in accordance with ASTM C 1060. For each survey, schedule to take core samples of at least two locations selected by the Building Owner to verify findings. Take additional test cuts at anomalies if requested by the Owner or Engineer. The independent testing firm shall submit copies of the report directly to the PGCPS Contract Representative. The Contractor shall replace damaged, missing or wet insulation identified in the report.

   1. Provide for additional inspections and reports by the independent testing firm until all damaged, missing or wet insulation has been replaced and submit the final report indicating no damaged, missing or wet insulation exists.

   2. Where deficiencies are indicated in the insulation, make corrective repairs as specified by the Engineer or Manufacturer, whichever is more stringent. Additional inspections and reports required to eliminate all deficient areas shall be completed at the Contractor's expense.

   3. If the Contractor finds that the existing insulation is dry and in good condition at two or more locations, where thermographic inspection indicates insulation anomalies, notify the PGCPS

Contract Representative and ask for additional direction. If the PGCPS Contract Representative requests that the Contractor continues to take and repair test cuts at the areas outlined in the thermographic inspection report, then the Contractor will be reimbursed on a time and material basis for any additional locations where damaged, missing or wet insulation was suspected, but not uncovered.

1.06 PROJECT CONDITIONS

A. Weather Condition Limitations: Proceed with roofing work only when existing and forecasted weather conditions will permit work to be performed according to manufacturer's recommendations and warranty requirements.

B. Temporary Roofing: When adverse job conditions prevent permanent roofing and associated work from being installed according to requirements, and Contractor determines that roofing cannot be delayed because of need for job progress or protection of other work, install temporary roofing.

1. Installation and removal of temporary roofing, as required prior to proceeding with permanent roofing Shall be performed at no additional cost to the Owner.

2. Temporary roofing must be removed entirely prior to installation of roofing membrane unless otherwise directed by Engineer.

C. Provide positive retaining barricades on ground below work areas to prevent injury to pedestrians.

D. Protections: Provide temporary barricades and other forms of protection to protect general public and employees from injury and damage to property due to selective demolition work and roofing operations.

1. Provide protective measures as required to provide free and safe passage of pedestrians (employees and general public) to occupied portions of the building.

2. Erect temporary covered passageways as required by authorities having jurisdiction.

3. protect from damage existing finish work that is to remain in place and becomes exposed during demolition Operations

4. Schedule and sequence demolition of existing membrane, flashings, etc., so that the specified roofing and flashings can be installed within the same day as demolition, or sooner if rain is expected. Provide temporary weather protection during interval between demolition and removal of existing construction and installation of new construction to ensure that no water leakage or damage occurs to structure or interior areas of existing building.

5. Seal tie-in between existing and new roofing with positive watertight seal that is capable of resisting water ponding to two inches or maximum depth possible due to tearoff sequence. Where practical, raise edge of existing roofing above height required to prevent water flowing into insulation or building.

6. Remove protections at completion of work.

E. Damages: Promptly repair damages caused to adjacent facilities by demolition work.

F. Protect adjacent building surfaces from spilling and splattering of roofing materials. Clean all spilled and splattered materials at once.

G. Tankers only may be used. Kettles are not permitted. Tankers must be paced downwind of air intake vents and windows on the ground. Relocate tanker if winds shift or if directed by the Owner's representative because of complaints received from occupants. (Allow for down time to relocate tanker at Owner's request.) Place tarps and plywood under tankers at site and provide positive retaining barricades around tankers to prevent injury to pedestrians. Tankers must be removed from site daily after cessation of day's operations. No hot kettles will be used. These precautions must be taken due to special considerations of safety of children that may access school grounds after normal school hours of

operation.

H. Access to Building Interior: Contractor may not access the building to use restrooms or telephones. Access to building interior will only be granted for work purposes (i.e. finding and repairing leaks, installing roof drains and drain lines, etc.).

I. Electricity and Water: The Facility will provide access to electricity and water for Contractor's use while work is being performed.

J. Phased construction of built-up roofing membrane will not be permitted.

1.07 SPECIAL CONDITIONS

A. The Contractor is responsible for conducting work so normal routines, activities and procedures at the building are not disturbed. Coordinate work with the Owner's Site Representative. The Contractor must have a foreman, who is fluent in English, on site whenever any Contractor or Sub-Contractor employee is at the site.

B. The Owner's Site Representative shall have the power to order the permanent removal from the premises any employee of the Contractor for interference with the building's operation or for incompetency. Furthermore, the Owner's Site Representative shall have the power to stop work if the Representative believes the work is not progressing in accordance with the Contract Documents or membrane manufacturer's specifications. The Contractor shall immediately comply with this order.

1.08 DELIVERY STORAGE AND HANDLING

A. Store and handle roofing materials to ensure dryness. When pallets of insulation arrive at the site, completely remove manufacturer's wrapper after confirmation of product meeting specification criteria and cover insulation with tarps. Provide tarps free of holes or tears and extend tarps below top surface of wood pallets. Alternatively, store in a dry, well- ventilated, weather-tight place. Unless protected from weather or other moisture sources, do not leave unused felts on the roof overnight or when roofing work is in progress. Store rolls of felt and other sheet materials on end on pallets or another raised surface. Handle and store materials or equipment in a manner to avoid significant or permanent deck deflection.

1.09 WARRANTY

A. Manufacturer's Warranty: Submit executed copy of roofing manufacturer's "No Dollar Limit" total roofing system warranty covering the roofing membrane, flashing INCLUDING LIQUID FLASHING, manufacturer fabricated metal components and insulation. Warranty must be signed by an authorized representative of built-up roofing system manufacturer, on a form that was published with product literature as a date of Contract Documents.

1. Warranty Period: Twenty (20) years from date of Substantial Completion.

2. Wind Speed Provisions: Up to and including wind speeds of 90 miles per hour.

B. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

C. Contractor's Warranty: Submit an executed copy of the Contractor's written warranty covering workmanship failures for a period of two years in accordance with article 19 of the General Conditions. In the first two years, the Contractor shall repair all leaks within 24 hours of notification of leak.

D. State Warranty Requirements from DGS Manual:

1. CONTRACTOR'S GUARANTEE

a. THE CONTRACTOR must have at least 5 years experience installing the type of roofing they are bidding on.

b. THE CONTRACTOR must be a NDL certified roofing system installer for at least 5 Years continuously (currently), and must provide to the State a current letter from a roofing materials manufacturer stating this and that their workmanship, including flashings and sheet-metal work, will be fully covered by the Manufacturers' 20 year 'NDL' warranty without exception.

c. THE CONTRACTOR must also provide the State with a minimum 2 year workmanship guarantee.

PART 2 - PRODUCTS

ROOF INSULATION

A. General: The insulation system on each section of replaced roofing may vary depending on specific site conditions. The optimum Long Term Thermal Resistance (LTTR) R-value is R-25 or better, however lower R- values may result due to existing site conditions.

1. State Insulation Guidelines from DGS Manual:

a. HEAT TRANSMISSION: Insulation heat transmission values shall be established in accordance with the Energy Conservation Guidelines, Chapter V and Code Update of 2015 DGS Procedure Manual. For new buildings the suggested R value of the roof area envelope is R-30CI (Cont. Insul.) for low slope roofs. For roof replacements/renovations on older buildings, a lower "R" value will be considered.

b. INSULATION shall be applied in several layers, with the joints staggered, in accordance with the manufacturer's recommendation.

c. COMPATIBILITY: Insulation material installed between the roof deck and the roof ply shall be compatible with the roof ply material and asphalt bitumen binder or other adhesive used in the roofing system.

d. WARRANTY: Insulation materials shall be considered an integral component of the roofing system; and shall be furnished or approved by the roofing system manufacturer; and shall be covered fully by the roofing system warranty.

2. Important Roofing Replacement New Roof Insulation Design Considerations:

a. At older buildings with design live loads less than the current standard (30 PSF plus drift) and where roof insulation was not originally a component of the roof design (dead load vs. live load), care must be taken not to subtract from the existing substandard live load so that the weight of heavy wet snow may still be safely accommodated. In such circumstances, less base insulation as well as less or no tapered insulation or insulation with less slope will be applied to reduce the overall added weight of the new insulation reducing the R-value by necessity as well. Manufacturer's new insulation systems must be designed with the structural limitations of older structures as an important consideration.

b. Building roof areas with perimeter through-wall flashings that transfer internal wall moisture via the through- wall flashing require special consideration. Do not bury or overtop existing through-wall flashings. Apply less base insulation in these areas if required as well as less or no tapered insulation so as not to negate the original building flashing design and cause long term roof moisture infiltration.

c. At buildings with windows, translucent wall panels or other fenestration low to the roof surface require special consideration with regard to the depth of new insulation. Window sills should be no less than 8" above the finished roof surface and preferably 12" above the finished roof surface. For roof areas with window sills that are already below the minimum, less base insulation and no tapered insulation may be required.

d. At roof areas with a high concentration of mechanical equipment, ductwork, piping, etc., improving the existing roof slope of the roof with tapered insulation may not be practical due to the amount of effort and expense required in such a restricted space.

e. At historic buildings, the overall rise of new tapered insulation systems at the roof perimeter with relation to established architectural features may detract from the building's historic appearance or may not be entirely compatible with the original architectural design.

f. Insulation systems should be designed with knowledge of specific site conditions. Evidence of ponding, too few drains, and other specific observable conditions at specific roof areas should be considered and accommodated within the manufacturer's insulation system design. Manufacturer's insulation system designs should not be based solely on the most straightforward geometric configuration. Larger scale ponding issues should be remedied by the application of tapered insulation as opposed to excessive flood coating and graveling to reduce the overall weight of the remedial improvements.

3. Manufacturer's shop drawings should reflect and accommodate the above Design Considerations.

4. Manufacturer's shop drawings should include revised roof perimeter details if the manufacturer's design does not resemble the Architect's design.

a. The Contractor must make the Manufacturer aware of specific site conditions and limitations that will affect the manufacturer's insulation system design.

b. State Site Visit Requirements from DGS Manual:

1) A SITE VISIT to verify existing conditions will be made for all roof replacement and roof repair projects to verify existing conditions and dimensions even though as- built drawings are provided. Where composition, thickness or make up of the existing roof system or any of its components cannot be determined by visual means alone, an exploratory investigation shall be conducted to include dismantling or opening up a representative portion of the roof system. Patch and make watertight all areas disturbed during investigation.

5. Manufacturer's Shop Drawings that do not reflect the Architect's State Approved Design, must be submitted to the State for approval prior to construction taking place.

B. Slope: The desired slope for the finished surface of the insulation is ¼ inch per foot. The existing structural concrete deck has some sloped gypsum fill in place. So new tapered insulation must be diligently coordinated with the structure to provide the required slope. In addition, provide tapered insulation crickets to improve drainage between scuppers. Provide Manufacturer's Shop Drawings indicating the tapered or flat insulation plan for each roof section. Note that the Roofing Contractor must carefully coordinate installation of insulation, crickets, membrane and membrane patches with other Contractor's work to ensure there is no ponding on the roof when the work is complete. The roofing Contractor will be required to replace insulation and membranes as required to eliminate ponding.

1. State roof slope guideline:

a. LOW SLOPE ROOFS shall be required to have a minimum slope of 1/4 inch per foot. New buildings shall be designed to achieve the minimum slope of 1/4 inch per foot structurally. Existing buildings may have to be provided with tapered insulation to achieve the minimum slope. Lightweight concrete shall not be used to create slope.

2. The desired slope (1/4 inch per foot) may be affected by specific mitigating site conditions at existing buildings or specific roof areas that limit or restrict the finished roof elevation or the amount of additional weight that can be added to the existing roof structure. In such cases, insulation of a lesser slope (1/8" per linear foot) for a lesser overall rise (depth) or even no additional slope or rise

may be necessary.

3. State roofing design criteria:

   a. FOR ROOF REPLACEMENT PROJECTS, the selection of the replacement roofing system shall be based on an evaluation of costs associated with factors affecting the proposed system, including span dimension, structural condition, foundation design/capacity, and disposition or accommodation of roof top equipment.

C. Base(flat) Insulation:

1. First layer: (Polyisocyanurate Foam Board): Rigid boards with minimum density of 1.7 pcf polyisocyanurate- based foam core, permanently bonded to roofing felt facer sheets. Provide boards 2 inches thick. If there are mitigating specific site factors restricting insulation depth (height) or weight, 1 inch polyisocyanurate insulation may be used in place of 2 inch. Use thickness shown on Drawing or the approved Manufacturer's Shop Drawings.

2. Second layer (cover board): (Perlite Duraboard or equal): Rigid Boards. Provide boards 1/2 inch thick.

3. The first layer of insulation will be 4'0" x 4'0" and must be walked in place per the Manufacturer. The second layer is to be the same size and also walked in place.

4. The desired average R-value (R-20) or less if there are mitigating site factors. Minimum desired thickness is 2 inches for flat or base insulation with a minimal R-value of 12.00.

D. Tapered Insulation:

1. Provide tapered Polyisocyanurate boards to improve slope to drain where indicated, fabricated with taper of 1/8 inch or 1/4 inch per foot. The desired finished slope of the roof is ¼" per foot. The finished slope is a combination of the built in slope (slope of roof deck) plus tapered insulation. A roof with a 1/8" built in slope requires a 1/8" slope improvement with tapered insulation to provide a ¼" finished slope to drain. Older buildings with structural weight limitations may only receive partial slope improvement or improvement that is less than the desired ¼" finished slope. The weight of any new insulation may not exceed the existing buildings structural limitations.

2. Provide tapered crickets to provide improved slope to drain where indicated, generally fabricated with ½ inch tapered Perlite insulation. Crickets covering a larger area to remediate ponding for example may consist of tapered insulation of a lesser slope to reduce weight and or height..

3. Install ½" perlite cover board (Duraboard) over all polyisocyanurate tapered insulation.

E. Minimal R-value:

1. Minimum depth for flat or base insulation is 2 inches with a minimal R-value of 12.00. The desired R-Value overall including tapered insulation is R-20 and optimum desired R-factor of older buildings would be R-25 plus, however specific site conditions must be considered.

2. State Insulation Guideline:

   a. ALL LOW SLOPE ROOFING SYSTEMS shall include insulation. The majority of insulating value shall be accomplished with the necessary thickness of flat poly-isocyanurate boards. Where necessary, roof slope shall be developed with tapered perlite or tapered poly-isocyanurate board.. Organic insulation material shall not be used under built-up roofs. Light weight concrete insulating fill is not acceptable. In all cases a minimum 1/2" cover board must be installed over the Isocyanurate insulation. Perlite and "Densdeck" are acceptable cover board materials.

F. Coverboard if specified (Perlite Board Duraboard or equal): Rigid, noncombustible, perlite/fiber boards.

G. Insulation R-value of 2.78 at 75 deg. F (24 deg C), complying with ASTM C 728: manufacturer’s standard sizes.

H. Fill and Replacement Insulation (Perlite Board): Rigid , noncombustible, perlite/fiber boards. Provide thickness required so top surface of fill insulation at low point is flush with level surface of adjacent deck. Trim perimeter of fill insulation as required to provide level surface. Provide ½ or 1 inch thick (or thickness required by manufacturer) cover boards over tapered polyisocyanurate insulation.

I. Preformed Edge Strips: Rigid insulation units matching roof insulation molded to form 2-1/2-by 3-1/2inch 45 degree cant strips and 1-1/2-by-12-inch tapered-edge strips

J. Insulation fasteners (Steel Deck): Extended corrosion resistant carbon steel screws with composite fluorocarbon coating in a matrix of organic polymers, resins, pigments and corrosion inhibitors. Finish must survive 30 or more cycles of Kesternich testing (DIN 50018) with no significant corrosion (Sentri by Dekfast) with steel or plastic plate for factory mutual [I-75} I-120 approved installation.

K. State guidelines for Substrate Preparation Prior to Placement of Insulation and the Roofing System:

1. PRIOR TO PLACEMENT OF INSULATION and the roofing system, all low slope roof decks shall have:

   a. Steel Deck: 1" perlite insulation mechanically fastened and 2 plies of fiberglass felts.

   b. Concrete Deck: Asphaltic primer and 2 plies of fiberglass felts.

   c. Nailable Decks: (other than Wood, Lightweight Concrete, Gypsum, and Tectum) Rosin-sized sheathing paper, 75 lb. ventilated base sheet, mechanical fasteners dictated by deck type, and 2 plies of fiberglass felts.

   d. Wood Decks: Mechanically fasten 1" thick perlite insulation to deck and install 2 plies of fiberglass felts with hot asphalt.

L. Provide products specified by roofing manufacturer to comply with the above requirements for the specific deck type(s) included in this project - as required by the roofing Manufacturer.

1. PGCPS specifications typically require one 28 lb. base sheet only for nailable deck types requiring a base sheet (gypsum, perlite concrete, tectum, wood).

3.02 MECHANICAL EQUIPMENT INSULATION

A. Duct--Rigid Insulation System

1. Install rigid foil-faced fiberglass duct insulation as made by Knauf (FSK 1-1/2 inches thick or thickness specified). Adhere using adhesive or non-penetrating, stick-on fastener that does not penetrate the metal duct work. Miter the insulation at all joints and access openings. Follow manufacturer's specifications.

2. Install a fully-adhered, white EPDM 45 mil rubber sheeting over the insulation. Miter and lap all joints; laps will not block the flow of water.

3. Use the white EPDM rubber as made by Carlisle. The rubber is to be fully adhered with glue/.

4. Install as a patch over the metal fastener. This is to eliminate sharp points going into the outside membrane.

5. Perform minor duct repairs as required to furnish a completed system. Re-support duct work as required to protect the roofing system and provide for a completed project.

B. Chilled water pipe insulation will be polyethylene tubing. Insulate the chill water and return lines from the roof unit to the roof deck. Use an insulated tubing as manufactured by Thermocell or equal. Apply glue to all joints and tapered connections. Sidewall thickness of tubing will be 3/4 inch minimum, but not less than that required by the 1996, BOCA National Mechanical Code, Amended.

3.03 BASE SHEET

A. Base Sheet: ASTM D 4601, Type I, 28 pound, nonperforated, asphalt-impregnated and-coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides.

B. Fasteners (base sheet): provide industry-standard types of mechanical fasteners, including cap or plate. For built-up roofing system work, tested by manufacturer for required pull-out strength to meet Factory Mutual Uplift Resistance Classification I-120.

C. Gypsum Patching Material (deck repairs): ASTM C317, Class A, minimum compressive strength 500 psi, Density not more than 60 pounds per cubic foot, Mill mixed gypsum concrete consisting of calcinated gypsum and suitable aggregate, requiring addition of drinkable water and fibrous reinforcement only at the job site, use bonding compound recommended by gypsum material manufacturer.

D. A smaller square footage of ventilated base sheet may appear as an Alternate for application as needed at areas of saturated deck.

3.04 BUILT-UP ROOF MEMBRANE SYSTEM

A. Insulated-Deck, Asphalt, Glass Fiber, Gravel Surfaced, Roofing: Provide built-up gravel surfaced roofing system with asphalt bitumen and four plies of glass-fiber felts (not counting base sheet) for layup as follows:

1. Ply Felts: Four(4) plies of asphalt-impregnated, glass-fiber felts, complying with ASTM D 2178, Premium Type VI.

2. Bitumen: Roofing Asphalt: Asphalt shall be approved grade steep complying with latest revision of ASTM D312 Specification for Type III and Type IV asphalt, unless otherwise specified. The Contractor must maintain and be able to prove, the following temperatures at all times to the satisfaction of the Owner’s Representative. Failure to do so will constitute grounds for a halt in production. There is some leeway in the manufacturer’s application temperature. It is our intent to obtain equiviscuous temperature (EVT) of asphalt. Application of asphalt throughout the day will be at that temperature.

   a. Type III Steep:

      1) 425° F. ± 25° F

      2) 450° F. ± 25° F

   b. Type IV Steep: Temperature for Mop

      1) 450° F. ± 25° F

      2) 475° F. ± 25° F

   c. Asphalt Fume Odor: Contractors must identify areas that may collect or allow odors to enter the building. Therefore, locate the tanker in the best location to reduce odors. On a daily basis, plastic must be installed over air intakes of the building in the areas where the contractor is working. The asphalt will have the additive from Roof Odors Solutions (or equal) added per manufacturer’s recommendation to all asphalt to help control fume odors.

3. Aggregate Surfacing: ASTM D 1863, Texas white chip #7 (a 3/4" stone), Georgia grade white marble chip free of sharp edges, or equal, and shall be acceptable for roofing (clean, dry and free of dust, soil, and foreign matter). No pea gravel or other riverbed materials are acceptable. Provide samples to the PGCPS Contract Representative for approvals prior to application.

4. Mineral Surfaced cap Sheet (Flashing): Single Ply of non woven polyester felt with asphalt coating and factory-applied ceramic coated granules and acrylic coating; ASTM D 6163

   a. Thickness: 160 mils

b. Asphalt: SBS modified for setting in hot asphalt.

c. Color/Coating: Provide white, ceramic coated granules and factory applied white, acrylic coating with minimum Solar Reflective Index (SRI) of 92, minimum initial solar reflectivity of 0.76, and minimal initial emissivity of 0.84.

d. Provide DynaKap or equal.

5. Comply with NRCA “Roofing and waterproofing Manual”, Specification Plate 42--IAGA, Diagram A.

3.05 BUILT-UP ASPHALT ROOFING SYSTEM EDGE/PENETRATION MATERIALS

A. Roofing Cement: Fibrated asphaltic cement, asbestos-free, complying with ASTM D 4586.

B. Fabric: ASTM D 173, asphalt saturated cotton fabric, 3.5 ounces per square yard.

C. Base Flashing: Two Type VI ply felts covered with mineral surfaced cap sheet (DynaLastic 180 FR CR G or approved equal).

1. The base flashing shall be a high performance flashing membrane. This product shall be a polymer-modified bitumen product made with polyester reinforced layers.

2. This material must meet and exceed the manufacturer’s 20 year guarantee.

D. lead Flashing: 3 lb/sf or 4 lb/sf sheet of common pig lead.

3.06 ROOF DRAINS AND PIPING

A. Roof Drains: Cast iron roof drains with flange, cast iron clamping ring, under deck clamps and cast iron domes. Provide stainless steel hardware (washers, bolts, threaded rod, nuts, etc…) for securing clamping rings to drain bodies. Field measure to match size of existing drains and to fit existing storm drain lines, 4 inch diameter (typical). Confirm all drain dimensions on site prior to ordering replacement drains.

1. Wade Division Tyler Pipe; W-3000 and 3200

2. Jay R. Smith; # 1010 and 1330

3. Josam; 21500

4. Zurn; ZC100 and ZC111-W4

B. Pipe (cast iron): ASTM A 74, Service Grade (SV) 4 inch diameter typical), cast iron pipe fittings to be used for this work. Use ASTM C564 rubber gaskets for pipe and fitting. EPDM (rubber) no-hub (plain end flexible) pipe couplings, with stainless steel band clamps, may also be used. Provide all required plumbing accessories. Confirm all piping dimensions on site prior to ordering piping components.

C. Pipe hangers: Fed Spec WW-H-171E, Type 1 or 10, adjustable pipe hangers with steel hanger straps and ½ inch diameter threaded rods.

1. Use ASTM C 564 rubber gaskets for pipe and fitting. EPDM (rubber) no-hub (plain and flexible) pipe Couplings, with stainless steel band clamps, may also be used.

2. Provide all plumbing accessories required to tie drains into existing storm drain lines.

D. Pipe insulation: ASTM C 547, heavy density fiberglass, I inch thick with embossed kraft paper, polyester scrim And aluminum foil jacket vapor barrier; size to fit pipe, tape joints.

3.07 SHEET METAL ACCESSORY MATERIALS

A. See “ Sheet metal and Flashing”

3.08 MISCELLANEOUS MATERIALS

A. Anchor Bolts (Wood blocking): Federal Specification FF-S-325, Group II, Type 4, Class 1 or type 3, Class 3; 1/2 inch diameter galvanized steel anchor bolt stud with expansion collar (Power-Stud® or Power Bolt ® by Power ® Fasteners). Length to penetrate substrate 2 ½ inches. Provide data showing proven performance of galvanized steel bolts in pressure treated lumber over a period of 30 years or upgrade specification to stainless steel.

B. Substrate Joint Tape: 6-inch - or 8-inch-wide, coated, glass-fiber joint tape.

C. Asphaltic Primer: Comply with ASTM D 41.

D. Galvanized sheet steel (deck repair): ASTM A 361, G90. 20 gauge.

E. Liquid Flashing System: JM Permaflash system including scrim and 2-part MBR flashing cemrent or pre-approved equal. System must be warranted by the roofing manufacture.

F. Nalins: Stainless steel nail with mushroom head in zinc body, 1/4" inch diameter, length to bed in substrate a minimum 1 ½" inches (Zamac Nailin by Powers). Predrill holes before installing fastener. Provide 1 inch diameter washers for securing base flanges.

G. Nails (roofing): Annular ring, flat head, 11 ga, compatible with material to be fastened, 1" diameter cap.

H. Nails (wood): 10 , 12, or 16 d, Type 304 stainless steel annular nails, length to penetrate substrate a minimum of 1 ¼ inches.

I. Plywood: 4 x 8 sheets of ½ inch or ¾ inch as specified FRT exterior grade plywood impregnated with chemicals by a pressure process or other means during manufacture, and which, when tested in accordance with UBC Standard 8-1 for a period of 30 minutes, shall have a flame spread of not over 25 and show no evidence of progressive combustion. Must have FRT stamp with fire rating.

J. Screws: (stainless steel): ASTM A 478, Type 304 stainless steel, pan or truss head, with neoprene washers, No. 8 x 1/2 inch for counterflashing.

K. Screws: (self- tapping): ASTM A 478, Type 18/8 stainless steel, pan or truss head self tapping screws, with neoprene washers; No. 10 x ½ inch foe fastening sheet metal and No. 12 x 2 ½ inch or length or diameter as required for fastening wood products to steel members.

L. Toggle Bolt: 3/8 0r ½ inch diameter, zinc plated two part machine screw and spring wing toggle bolt (Toggle Bolt by Powers or equal)

M. Walkpads: Preformed, modified asphalt, skid resistant walkpads recommended or provided by roofing system Manufacturer.

N. Wood members, Units: Provide wood pressure treated with waterborne preservatives for above-ground use (AWPB LP-2)

PART 3 - EXECUTION

4.01 DEMOLITION (SEE DIVISION 2)

A. Carefully layout the extent of existing roofing to be replaced as required for the renovation project. At locations Indicated on the Drawings, remove existing roofing ballast, membrane, flashings and insulation down to the deck as shown or indicated on the Drawings.

B. At tie-ins between new roofing and flashings and the existing membrane to remain, carefully spud away the existing gravel surfacing and flood coat to expose a minimum of 16 inches of the existing membrane. DO NOT damage the membrane. If the Contractor damages the membrane, the Contractor must spud additional 16 inches past the damaged area.

4.02 ROOF DRAIN INSTALLATION

A. Prior to starting membrane installation, replace existing roof drains with new cast iron roof drains. Relocate existing drains and install new drains and drain lines at locations indicated on Drawings and as

required to comply with current plumbing codes. Provide all cast iron pipe and plumbing accessories required to tie into existing storm drain lines or install new storm drain lines in accordance with current plumbing codes. Slightly modify the new drain locations where required to install drain lines around mechanical lines or duct work. Slope drain lines 1/8 inch per foot minimum. Support horizontal line with steel hangers. 5 feet on center (maximum).

B. Insulate drain lines in accordance with current plumbing code. Neatly core drill (do not use impact tools) through concrete decks and masonry walls (where required) to install new drain lines. Seal openings between pipe and masonry walls with grout, backer rod and fire rated sealant as required to maintain wall's current fire rating. Field verify locations for new drains and drain lines prior to submitting Manufacturer's tapered insulation Shop Drawings.

1. To reduce the chance of leaks, the Roofing Contractor (not the plumber) must (mandatory) provide the temporary watertight tie-ins at all roof drains.

C. Fill voids in deck, in accordance with Paragraph 3.4, caused by removal of existing roof drains. Install steel angles or wood blocking as required to provide sound substrate around new roof drain body. Repair or replace, in accordance with Paragraph 3.4, roof deck that is damaged by installation of roof drains. Please note that this work is included in the base bid and will not be reimbursed on a unit price basis.

D. Install roof drains so that top of flange is set on stable wood blocking and the flange will be 1 inch below surface of completed surrounding membrane and stripping. Secure drain bodies with under deck clamps.

E. Immediately after installation of drains and piping, plug drain line and flood test connections for 30 minutes. Insulate drain body after successful water tests.

F. Provide 8 foot sumps for drains if and whenever possible.

4.03 SUBSTRATE EXAMINATION

A. At locations where existing insulation has been removed down to the decking, examine substrate surfaces to receive replacement insulation. If deteriorated deck is uncovered, do not proceed with roofing until unsatisfactory conditions have been corrected in a manner acceptable to the membrane manufacturer. Repair deteriorated decking in accordance with the project Architect's or Engineer's direction.

B. Deteriorated sections of existing wood blocking specified to be re-used may be uncovered. Match existing wood dimensions. Secure new wood in accordance with the requirements of Factory Mutual Publication 1-49, perimeter Flashing"

4.04 GENERAL INSTALLATION REQUIREMENTS

A. Cooperate with inspection and test agencies engaged or required to perform services in connection with installation of built-up roof system.

B. Protect other work from spillage of built up roofing materials, and prevent liquid materials from entering or clogging drains and conductors, Replace/restore other work damaged when installing built-up roof system.

C. Insurance Code Compliance: Install built-up roofing system to comply with governing regulations and the following insurance requirements:

1. FM requirements for Class I or Noncombustible, including zoned wind resistance as specified by FM.

2. UL Fire Classified and Class 120 uplift resistance.

D. Install roof drains, overflow roof drains, scuppers and overflow scuppers on each roof section prior to installing built-up membrane on that section. Coordinate overflow scupper placement with windows and doors below and with the Manufacturer's Tapered insulation design. Do not install overflow scuppers in

locations where they will not be effective or will drain at window and door locations.

E. Existing perimeter wood blocking is designated to remain. Secure existing wood blocking, within 8 feet of corners or terminations, with anchor bolts spaced 48” on center. Stagger anchor bolts with existing anchors. Countersink anchors below surface of blocking and provide 3 inch minimum embedment depth into masonry or concrete.

F. Asphalt Bitumen Heating: Heat and apply bitumen according to EVT Method as recommended by NRCA. Do not raise temperature above 525° F; point of application temperature is 425°F±25°F for mop and 450° F±25°F for spreader. Do not raise temperature above minimum normal fluid-holding temperature necessary to attain EVT more than 1 hour prior to application. Discard bitumen that has been held at a temperature exceeding finished blowing temperature (FBT) for more than 3 hours. Determine flash point. FBT and EVT of bitumen, either by information from bitumen producer or by suitable tests. Determine maximum fire-safe handling temperature and do not exceed that temperature in heating bitumen. In no case heat bitumen to a temperature higher than 25 deg F below flash point. For aggregate-surfaced pour coats of bitumen, limit application temperature to minimum required for proper aggregate embedment and maximum that will permit retaining a coating of weight required. (depends on slope of surface).

1. Provide and use thermometers at the tanker and on the roof at the point of application. If thermometers are not on site during site visits by Owner’s Representative, work will be halted until thermometers are delivered.
2. The proposed location(s) of tankers, vehicles, and refuse containers shall be coordinated and approved by the Board. The use of asphalt kettles will not be allowed at any time during the course of this project.
3. Asphalt tankers must be in good working order and able to maintain the proper performance temperatures. The Board reserves the right to have any defective or non-properly functioning equipment removed from the premises by the contractor.
4. Asphalt tankers must not be stored on Board property overnight.
5. Asphalt Fume Odor: Contractors must identify areas that may collect or allow odors to enter the building. Therefore, locate the tanker in the best location to reduce odors. On a daily basis, plastic must be installed over air intakes of the building in the areas where the contractor is working.

G. Bitumen Mopping Weights: For interplay mopping, and for other moppings except as otherwise indicated, apply bitumen between plies at the rate of 25 lb of asphalt per roof square (plus or minus 20 percent on a total-job average basis).

H. Felt Application: Apply felts in bitumen at application temperature (425° ± 25° F for Mop to 450° F ± 25° F for spreader and immediately broom felts into bitumen. If felts are not broomed, work will be halted until project superintendent returns to site and supervises installation. In addition, The project Architect/Engineer, and or the PGCPS Contract Representative reserves the right to require two additional membrane test cuts (see above), for every time the Architect/Engineer or a PGCPS Representative observes the Contractor not brooming the felts.

I. Substrate Joint Penetrations: Do not allow bitumen to penetrate substrate joints and enter building or damage insulation, vapor retarders, or other construction. Tape joints where mopping is applied directly to the substrate.

J. Tie-Ins: Where tying into existing roofing after carefully preparing the existing membrane as described above, clean and prime the existing membrane before applying the new roofing materials. At several tie-in locations between new and existing membranes with differing insulation heights, install tapered edge strips in order to provide a smooth transition between the new insulation and existing insulation to remain.

K. Cutoffs: At the end of each day's roofing installation, provide watertight tie-in to adjacent existing roofing. At a minimum, install a temporary tie-in of two plies of No. 15 roofing felt set in full moppings of hot bitumen; remove at beginning of the next day's work. Note that the two plies tie-in is the minimum required, the Contractor must prepare the existing membrane and install whatever system necessary for protection from water penetration.

L. General: Comply with insulation manufacturer's instructions and recommendations for handling, installing, and mopping or anchoring insulation to substrate. Coordinate State requirements for deck preparation prior to insulation installation with Manufacturer's requirements for the type(s) of deck included.

M. Base Sheet: Mechanically fasten base sheet to the existing deck with fasteners specifically designed and sized for the attachment of the specified base sheet to the site specific prepared substrate.

N. Two-layer insulation (mandatory): Install flat polyisocyanurate insulation (bottom layer) and flat perlite (Duraboard) or tapered polyisocyanurate insulation followed by flat perlite (Duraboard) as follows:

1. Mechanically fasten the base layer of polyisocyanurate insulation to steel deck (where applicable) with Manufacturer specified screws and plates to meet Factory Mutual I-120 (uplift) approved installation and approved Manufacturer's Shop Drawings. Run long joints of insulation in continuous straight lined, perpendicular to roof slope, with end joints staggered (6 inches minimum) between rows.:

2. Install base layer of insulation at metal deck areas and second and subsequent layer(s) of flat or tapered insulation with joints of second layer offset from joints of first layer a minimum of 12 inches in each direction, Install subsequent layers in full mopping of hot Type III asphalt applied within temperature range of EVT, plus or minus 25 deg F and at a rate of 25 lb per 100 sq. ft. (plus or minus 25 percent on total-job average basis). For tapered insulation, follow insulation drainage pattern shown on Drawing or State Approved Manufacturer's tapered insulation Shop Drawings

O. Check tapered insulation placement with 4 foot level on 10 foot straight edge to confirm slope prior to placing built-up membrane. Advise the PGCPS Contract Representative immediately if slope is less than ¼ inch per foot. NOTE: If ponding greater than ¼" deep remains after 48 hours after rain, the Contractor may be required to cut out, remove and replace the roofing system to make it free draining, if it is determined that the tapered insulation has been incorrectly installed or fill insulation was not installed.

P. Install insulation crickets in 33 lbs per square mopping of hot asphalt to provide drainage. Install crickets as shown on approved Manufacturer's tapered insulation Shop Drawings and with a minimum aspect ratio of 3:1 (length to (width) unless otherwise directed by the project Architect/Engineer.

Q. Trim surface of insulation at primary roof drains/scuppers so insulation is lower than adjacent insulation as typically shown on the drawings to promote effective drainage. Provide 8' sumps at roof drains.

R. Cant strips/tapered edge strips: Except as otherwise shown, install preformed 45-degree insulation cant strips at junctures of built-up asphalt roofing system membrane with vertical surfaces and install tapered edge strips in 33 pounds per square mopping of hot asphalt at perimeter nailers and other areas to provide drainage and a smooth transition for the new built-up membrane. Trim tapered edge strips to provide smooth transition to adjacent surfaces.

4.05 ROOF MEMBRANE INSTALLATION

A. Shingling Plies: Install membrane with ply sheets shingled uniformly to achieve specified membrane thickness throughout.

B. Membrane Ply Sheets: Install four (4) plies of Type VI Premium fiberglass felts lapped (shingled) to form a continuous, uniform membrane with continuous bitumen moppings between sheets so that ply sheet does not touch ply sheet.

1. Mop base ply of membrane to insulation. Broom in with soft broom or squeegee. THIS IS MANDATORY.
2. Sequence work to minimize foot traffic on recently installed felts and to prevent cart traffic (i.e. - lugger, mop cart, etc.) on recently installed felts. THIS IS MANDATORY. If cart traffic or excessive foot traffic is discovered/observed by the Architect/Engineer, the Contractor will be directed to install an additional 4 plies of membrane, extending three feet beyond the affected area (in all directions), at the Contractor's expense.
3. Provide a folded-back envelope at edges and penetrations of built-up roofing membrane where it is not turned up on a tapered edge strip to provide positive protection against flow of bitumen into building or off the edge. Install one ply of coated felt set in steep asphalt with joints sealed. Seal corners and other interruptions of envelope with large beads of roofing cement to protect against bitumen flow.

C. Aggregate Surfacing: Promptly after installing and testing roofing membrane, base flashing, and stripping, flood Coat roof surface with 60lb/sq. ft. of hot roofing asphalt. While flood coat is hot and fluid, cast the following average weight of aggregate in a uniform course:
   1. Ballast or Aggregate shall be Texas white chip #7 (a 3/4" stone), Georgia grade white marble chip, or equal, and shall be acceptable for roofing (dry and free of dust, soil, and foreign matter). No pea gravel or other riverbed materials are acceptable. Provide samples to the PGCPS Contract Representative for approvals prior to application.
   2. Aggregate weight: 500 lb/100 sq. ft.
   3. If aggregate surfacing is delayed, promptly apply glaze coat of hot asphalt at a rate of 10 lb/100 sq. ft.

D. Set-on Accessories: Where small roof accessories are set on built-up membrane, set metal flanges in a bed of roofing cement and seal membrane penetration with bead of roofing cement to prevent flow of bitumen from membrane

E. Equipment Closures and Curbs: Coordinate shutdown with mechanical contractor and remove and reinstall exhaust fans and other equipment flashings as required to install wood blocking and base flashing. Install additional treated wood blocking as required to raise equipment curbs to provide a minimum of 10 12 inches clearance between top of curb and top of completed roof membrane. Install new aluminum curbs for exhaust fans and gravity vents if specified.
   1. The existing gravity vent curbs will be replaced with new aluminum curbs. The Mechanical contractor shall perform a site survey to gather all required information for replacement prior to ordering replacement curbs.
   2. The existing rooftop power ventilator curbs will be replaced with new aluminum curbs. The Mechanical contractor shall perform a site survey to gather all required information for replacement prior to ordering replacement curbs.

F. Perimeter Nailing: At the roof perimeter, secure loose existing wood blocking to remain to meet the Factory Mutual Data Sheet 1-49, "Perimeter Flashing" requirements. At a minimum, anchor bolts must be located 2 feet on center in the field and 1 foot on center within eight feet on the corners. As required by tapered insulation heights, secure additional wood blocking (as shown on Drawings) or as needed to the existing blocking with stainless steel nails in accordance with Factory Mutual Data Sheet 1-49, "Perimeter Flashing". Where indicated, install new wood blocking over existing substrates with anchors/fasteners specified. After installing wood for gravel stops, cover wood with manufacturer's peel and stick membrane prior to cladding with aluminum. Lap peel and stick membrane about one inch over wall below. Specified gravel stop/fascias must cover peel and stick membrane.

4.06 COMPOSITION FLASHING AND STRIPPING

A. Install composition flashing at cant strips, at other sloping and vertical surfaces, at roof edges, and at penetrations through roof. Install composition flashing in accordance with membrane manufacturer's specifications and the following:

1. Base flashing: In uniform coats of hot steep asphalt, install first felt extending from within ½ inch of the top of the counterflashing to not less than 4 inches into the membrane and second felt extending from within ½ inch of the top of the counterflashing to not less than 8 inches onto the membrane. (Extend felts to the top of curbs). On top of this, apply a uniform coat of hot applied steep asphalt and embed one ply of pre-coated, mineral surfaced, modified cap sheet base flashing in accordance with membrane manufacturer's requirements. Plies must be laid in smoothly with no pockets, wrinkles, buckles or voids. Care should be taken to assure that all flashing membrane end laps (3 inch minimum) are fully embedded in asphalt. All plies and cap sheet shall be extended (3) three, (6), and (9) inches respectively onto the deck surface. Seal all exposed flashing joints with roofing cement and fabric. Apply asphalt surface coat and gravel up to toe of cant. Fasten top of base flashing with capped nail-ins (masonry) or screws (wood), 6 inches on center. Where top of flashing is less than 8" above membrane, seal top of flashing with 2 plies of cement and fabric. Immediately install counterflashings over completed base flashings or cover with temporary waterproofing. Where the top of base flashing is left exposed longer than 48 hours or exposed to moisture, the base flashing shall be replaced if requested by the PGCPS Contract Representative or Architect/Engineer.

   a. Base flashing (Dynalastic 180 FR CR G or approved equal) at perimeter edge detail will be the full width 18" wide.

   b. On a wall cap, install Dynalastic 180 FR CR G or approved equal up the wall and under the new metal cap.

   c. An additional cap sheet layer (Dynalastic 180 FR CR G or approved) equal will be installed along all perimeter cants and gravel stops 18 inches wide.

   d. An additional cap sheet layer (Dynalastic 180 FR CR G or approved equal) will be installed along all built-up roof ridges and along all built-up roof valleys.

2. Stripping (gravel stop, vent pipe, etc.): Strip flanges to membrane with two plies of flashing felts set in hot bitumen. Install first felt extending from vertical projection to not less than 6 inches onto the membrane and second felt extending from vertical projection to not less than 8 inches onto the membrane. On top of this, apply a uniform coat of hot applied steep asphalt and imbedded one ply of pre-coated, mineral surfaced, modified cap sheet base flashing in accordance with membrane manufacturer's requirements.

3. Roof Drains: After 4-ply base plies are installed, flash roof drains with manufacturer's warranted liquid drain flashing system including scrim and 2-part dry curing flashing cement. Inspectors will look for scrim and liquid flashing extending into the drain bowl per the manufacturer's installation details. Apply liquid drain flashing per manufacturer's requirements. On top of this, apply a uniform coat of hot applied steep asphalt and embed one ply of mineral surfaced cap sheet in accordance with membrane manufacturer's requirements. Extend membrane plies, liquid flashing and cap sheet under clamping ring. Install clamping ring secured to drain body with stainless steel hardware. Do not allow bitumen to migrate to drain openings. If flashing causes a dam around drain, the Contractor will be required to remove and reinstall drain as required to eliminate ponding. To protect the insulation, install clamping rings over the membrane at the end of each day before leaving site, even if liquid flashing and cap sheet have not been installed. Where Contractor relocates existing drains, ensure the drain bodies are set an inch below the adjacent insulation. Then install the new membrane, liquid flashing, and mineral surface cap sheet as described above.

B. Allow for expansion of running metal flashing and edge trim that adjoins roofing.

C. Counterflashings, gravel stops, through-wall flashings, vent pipe flashings, expansion joints, and similar sheet metal work to be coordinated with built-up roofing work are specified in other sections of these specifications.

4.07 WALKPADS

A. Install modified bitumen walkpads at described locations in the job description or on drawing. Use DynaTread Plus as made by Johns Manville, 813mm X 813mm or equal.

1. Walkpads will be placed around the entire perimeter of large rooftop units and equipment, at ladders, roof scuttles, and where indicated on the bid drawing.

2. Walkpads will be fully adhered.

4.08 PROTECTING ROOFING

A. Upon completing roofing, including associated work, institute appropriate procedures for surveillance and protection of roofing during remainder of construction period. At end of construction period, or at a time when remaining construction will in no way effect or endanger roofing, inspect roofing and prepare a written report with copy to Owner’s Representative describing nature and extent of deterioration or damage found.

B. Repair or replace, as required, deteriorated or defective work found at time of above inspection to a condition free of damage and deterioration at time of Substantial Completion and according to requirements of specified warranty. Then, perform the specified moisture survey.

PART 4 - ADDITIONAL MECHANICAL EQUIPMENT REQUIREMENTS AND CONSIDERATIONS

5.01 GENERAL

A. All mechanical work shall be performed by a licensed mechanical contractor. All mechanical work shall be performed with strict adherence to all pertinent codes and regulations. All mechanical work shall be performed in a manner that causes the least amount of disruption and shortest service interruption to this facility. Work requiring service disruptions shall be planned during off hours as much as possible. All service disruptions must be scheduled in advance Mechanical work performed in a substandard fashion will be photo- documented and may affect future bidding eligibility.

B. Stacks and vents:

1. Replace the existing boiler and water heater stacks and collars with new stainless steel double wall stacks and new stainless steel collars. See Specification Section 15550.

C. Freon lines for HVAC units: Re-insulate all freon lines for HVAC units.

D. Gravity Vents:

1. The existing gravity vents will be replaced with new aluminum gravity vents matching existing. The Mechanical contractor shall perform a site survey to gather all required information for replacement prior to ordering replacement gravity vents.

E. Raise existing rooftop HVAC equipment to accommodate the new finished roof elevation after installation of new base and tapered insulation. Provide new and or extend existing supports and curbs as needed to maintain required height above new roof surface. Extend existing ductwork and piping in kind as required. Replace missing or deteriorated pipe and ductwork insulation. The contractor is responsible for performing a rooftop survey to ascertain the scope of the mechanical work required.

F. All rooftop mechanical equipment must be curb or steel frame mounted. Any equipment previously mounted on loose wooden supports laying directly on the roof’s surface will be re-installed on new curb style equipment supports as shown in plans on the drawing sheet labeled Typical Details. See the State

of MD DGS Chapter VII Standards for New Roofing Construction, Re-Roofing Construction and Roof System Guarantee Requirements. All mechanical equipment shall be mechanically attached to equipment curbs mechanically attached to the roof structure. New equipment curbs shall be properly flashed, counter flashed and capped. All piping and electrical conduit must be firmly supported. All equipment installations must match general roofing uplift requirements. Re-installing equipment on loose lumber supports (in-kind) is not acceptable.

G. All existing equipment support penetrations shall be re-flashed with new stainless steel and will receive new base flashing. All caps for all penetrations shall fit securely over base flashing. Install additional stainless steel counter flashing as required to ensure that metal flashing laps over asphalt base flashing.

H. Provide required labor and materials to disconnect/connect and raise existing electrical service to all rooftop HVAC equipment as required. Electrical work permits and inspections are to be included in the base bid to raise ventilators and perform other electrical work. All electrical work shall be performed by a licensed electrical contractor. All electrical work shall be performed with strict adherence to all applicable codes and regulations. All electrical work shall be performed in a manner that causes the least amount of disruption and shortest service interruption to this facility. Work requiring service disruptions shall be planned during off hours as much as possible. All service disruptions must be scheduled in advance. See electrical Division 26.

I. Electrical work performed in a shoddy or substandard fashion will be photo-documented and may affect future bidding eligibility.

END OF SECTION

SECTION 07 6205
SHEET METAL FLASHING AND TRIM FOR ROOFING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specifications apply to this Section.

B. State of Maryland Department of General Services Office of Facilities Planning, Design and Construction Project Management and Design Division - Procedure Manual for Professional Services Roofing Standards July 2015 VII-8

1.02 SUMMARY

A. This Section Includes:

1. Aluminum Copings.
2. Stainless steel flashing receivers.
3. Prefinished aluminum counterflashings.
4. Prefinished aluminum expansion joint covers.
5. Lead vent pipe flashings.
6. Rigid conduit enclosures.
7. Stainless steel scuppers and overflow scuppers.
8. Rooftop unit curbs.

B. This Section Includes:

1. Division 02 “Selective Demolition” for demolition of existing roofing membrane and appurtenances.
2. Division 06 Section “Miscellaneous Rough Carpentry” for wood blocking and nailers.
3. Division 07 for roofing membrane installations.

1.03 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies as indicated shall withstand loads , structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Fabricate and install roof edge flashings and copings capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49:l

1. Wind Zone 1: For velocity pressures of 21 to 30 lbf/sq. ft.: 60 lbf/sq. ft. perimeter uplift force, 90-lbf/sq.ft. corner uplift force, and 30-lbf/sq. ft. outward force.

C. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Samples of the following flashing, sheet metal, and accessory items:

1. One, 8 inch square sample of each sheet metal material. Also provide one painted sample of stainless steel
2. One, 12 inch long section of stainless steel counterflashing and receiver.
3. One, 12 inch long section of stainless steel expansion joint cover with standing seam and continuous cleat.
4. One fully soldered lead boot and cap flashing for vent pipes.
5. One 12 inch long corner section of the prefinished aluminum coping with mitered corner, rubberized asphalt sheet metal stripping, back-up plate continuous cleat, and cover plate.
6. One rigid conduit enclosure. Approved submittal will be returned to Contractor.
7. One, fabricated stainless steel scupper including prefinished aluminum cover trim plate if through-wall type. Approved submittal will be returned to Contractor.
8. Manufacturer's Shop Drawings indicating proposed detail for each flashing condition or termination not specifically shown on Contract Drawings. Details must be similar to details shown on Contract Drawings and be permanently water tight without relying on sealant. Detail Shop Drawings that vary from Contract Drawing Details must be submitted along with the Manufacturer's Tapered Insulation Shop Drawings for State approval prior to performing detail work in field.

C. Warranty: Sample of special warranty.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

C. Fasteners for Treated Lumber and Sheathing: All fasteners securing or penetrating treated lumber and sheathing shall be stainless steel.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.07 PROJECT CONDITIONS

A. Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of work and protection of materials and finishes. The Drawings indicate most of the required details. Where a particular detail is not provided, provide a shop drawing and obtain the PGCPS Contract Representative'/Architect's approval for the proposed flashing detail. Solder all joints water tight, similar to those shown on Drawings. Note, all terminations shall be made watertight without relying on sealant or cement.

B. Masonry Mock-Up: Prior to ordering masonry materials, remove small sample of existing mortar and obtain custom color-matched masonry cement. Prepare masonry and point two square feet of three different mortar and sand mixes (6 sf total) at location selected by the Owner. Also install two different replacement brick masonry units. After 7 days of curing, the Owner's Representative will review the mock-ups. Obtain written approval of mortar and brick masonry selection before starting work. If

necessary, provide additional mortar and brick masonry until color and texture of dry , interior portions of the existing materials are replicated. Once approved, the mock-up area will become the standard for remaining work.

C. Masonry mock-up must be completed within 1 week of mobilization.

1.08 WARRANTY

A. Special warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

B. Exposed Panel Finish: Deterioration includes, but is not limited to the following:

1. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
2. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
3. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

C. Finish Warranty will be equal to Englert's warranty for it's PermaColor / Permametallic 2000 and Perma Color 3500 ULTRA-Cool finishes .

D. Finish Warranty Period: 20 years from date of Substantial Completion.

E. Submit copies of the standard 2- year roofing Workmanship warranty per Section 075556.l

PART 2 - PRODUCTS

2.01 SHEET METALS

A. General:

1. The Metalwork will be supplied by the Roofing Manufacturer and will be part of the total system NDL warranty.
2. Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Prefinished Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated and with not less than the strength and durability of alloy and temper designated below:

1. Aluminum Sheet : ASTM B 209, 3003-H14, with a minimum thickness of 0 .040inch, unless Otherwise indicated. Continuous gutters may be .032 inch. Cleats shall be one gauge heavier than material fastened or as recommended by metal manufacturer.
2. Fluoropolymer 2-Coat Coating System: Manufacturer's Standard 2-coat, thermocured system composed of specially formulated inhibitive primer and Fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 605.2
3. Provide 70% Kynar/Hylar based finish coating system equal in all aspects to that specified and warranted For 20 years by Englert as PermaColor2000
4. Finish coating shall be 1.0 + 1.0 mil total dry film thickness.
5. Wash coat of .3 to .4 mil dry film thickness shall be applied to reverse side.
6. The pre-painted, finished side shall be coated with a factory installed , strippable plastic film for protection of the finished surface during shipping, fabrication, and installation.
7. Color and Gloss: As selected by Owner from Manufacturer's full range of choices for color and gloss. a. The PGCPS Project Manager will choose the color to be used for this facility/project.
8. All prefinished aluminum shall be STUCCO EMBOSSED unless specifically stated otherwise.

C. Stainless Steel: Type 304, .025 (24 gauge) dead soft (Microflex), soft annealed stainless steel, and .015 terned stainless steel.

D. Lead: ASTM B 749, Type L51121, copper bearing sheet lead, minimum 4lb/ sf for drains and 4lb/sf for vent pipes. Fabricated vent pipe flashing boots a maximum one inch greater in diameter than vent pie to be flashed.

2.02 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by sheet metal/roofing Manufacturer.

B. Anchor Bolt (epoxy): ICC-ES ESR-1531, stainless steel epoxy anchor for use in normal weight structural Concrete, ½ inch in diameter (HIT-RE500 + HAS-R 304/316 By Hilti) Provide stainless steel nuts. Provide minimum 3-1/2 inch embedment or as shown on Approved Shop Drawings. All epoxy anchors MUST be installed by installers certified by the fastener manufacturer. Anchors must be capable of sustaining, without failure, a load equal to for times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified testing agency.

C. Backer Rod: Closed cell polyethylene foam rod or rope, 25 percent greater in diameter than joint width to be sealed. Joint widths vary. Different sizes will be required.

D. Band Clamp: ½ inch wide. All stainless steel band clamp with slotted worm drive fastening mechanism.

E. Batt Insulation: ASTM C 665, Type III, Class A fiberglass insulation.

F. Bituminous Coating: SSPC - Paint 12, solvent-type bituminous mastic, nominally free of sulfur, compounded for 15-mil dry film thickness per coat.

G. Brick Masonry: ASTM C 652, Grade SW, Type HBX, Size, shape and texture to match existing.

H. Fasteners: Same metal as flashing/sheet metal or other non corrosive metal as recommended by sheet metal manufacturer. Match finish of exposed heads with material being fastened. Galvanized steel fasteners are not acceptable for exposed applications. All treated lumber must be fastened with stainless steel fasteners.

I. Gypsum Board: ASTM C 36, 5/8 inch thick (or thickness to match existing), 4 x 4 or 4 x 8 sheets of gypsum board. Provide materials for joints and corner treatment complying with ASTM C 475, ASTM C 840, and recommendations of gypsum board and joint treatment materials Manufacturers.

J. Hammer5 Screws/Nailins: One step nail drive anchor with Zamac alloy body and stainless steel drive screw (Zamac Hammer Screw by Powers).

K. Hardware Cloth: Stainless steel hardware cloth, ½ inch by ½ inch, minimum wire diameter 0.30 inches.

L. Liquid Flashing System: JM Permaflash system including scrim and 2-part MBR flashing cemrent or pre-approved equal. System must be warranted by the roofing manufacture.

M. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, non-drying, nonmigrating sealant

N. metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation work, matching or compatible with material being installed, noncorrosive, size and gage required for performance.

O. Mortar: ASTM C 270 proportion specification, Custom blended, color-matched and pre packaged Type N Portland cement and Type S hydrated lime (Eaglebond by Lefarge; Flamingo-Brixment by Essroc; Custom Color Portland/Lime by Lehigh), 3 3/8 to 6 ¾ parts clean washed sand (not less than 2 ¼ and not more than 3 times the sum of the separate volumes of cementitious materials) and the maximum amount of water which produces a workable consistency. Color to match existing joints.

P. Nails (roofing): Stainless steel, 0.120-inch-diameter barbed shank, sharp-pointed, conventional roofing nails with a minimum 3/8-inch diameter head and of sufficient length to penetrate ¾ inches into solid decking or at least 1/8 inch through plywood sheathing.

Q. Nails (stainless steel - for wood): Type 316, stainle3ss steel common nails. Provide 10d, 12d, or 16d nails as required to penetrate at least 1 ¼ inch into wood framing.

R. Paint System (for stainless steel): Primer and top coat recommended by stainless steel manufacturer. Apply primer and 2 coats of paint in accordance with Manufacturer's recommendations. Color to match adjacent prefinished sheet metal.

S. Paper Slip Sheet: 5-lb. rosin-sized building paper.

T. Plywood: 4 x 8 sheets of ½ inch or ¾ inch as specified FRT exterior grade plywood impregnated with chemicals by a pressure process or other means during manufacture, and which, when tested in accordance with UBC Standard 8-1 for a period of 30 minutes, shall have a flame spread of not over 25 and show no evidence of progressive combustion. Must have FRT stamp with fire rating.

U. Roofing Cement: ASTM D 4586, Type I, non-asbestos roofing cement, asphalt, wet and dry.

V. Rubberized asphalt sheet membrane: Roofing Manufacturer's self adhering rubberized asphalt bonded to polyethylene sheeting and formed into flexible sheets, 56 mils minimum thickness (equal to Bituthene 3000/3100 by W.R. Grace and Co.; Polyguard 650 by Polyguard Products, Inc.) and for use under metal. Use primers , mastics and liquid membrane supplied by membrane manufacturer.

W. Rubberized asphalt sheet membrane: Roofing Manufacturer's self adhering, butyl based membrane bonded to polyethylene sheeting and formed into flexible sheets, 30 mils minimum thickness (equal to Ultra by W.R. Grace and Co) and for use under metal. Use primers, mastics and liquid membrane supplied by membrane manufacturer.

X. Screws (masonry): 1,4 inch diameter, corrosion resistant case hardened steel screws with composite Fluoropolymer coating. Length to penetrate substrate 1 ½ inches.

Y. Screws (stainless steel): ASTM A 478, Type 18/8 stainless steel, pan or truss head self-tapping screws, with neoprene washers; No. 8 x ½ inch for fastening metal to metal, No. 10 x 1 ½ inches for fastening metal to wood.

Z. Screws (self-tapping): ASTM A 478, Type 18/8 stainless steel , pan or truss head self-tapping screws, with neoprene washers; No. 10 x ½ inch for fastening sheet metal and No. 12 x 2 ½ inch in length and diameter as required for fastening wood products to steel members.

AA. Sealant (polyurethane): ASTM C 920, Grade NS, Class 25, two (type m) part polyurethane, non sag, sealant (Sikaflex 2c by Sika; Dynatrol II by Pecora; Sonolastic NP2 by Sonneborn). Color: to blend with primary material at sealant line.

BB. Sealant (polyurethane): One part polyurethane sealant, non sag, sealant. Color: to blend with primary material at sealant line.

CC. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyosobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape ½ inches wide and 1/8" thick.

DD. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with an acid flux of type recommended by stainless-steel manufacturer.

EE. Splash Blocks:

1. Provide Standard precast concrete splashblocks, 3000 psi precast concrete dish-profile units manufactured for purpose. Light weight patio blocks are not acceptable.

2. For downspouts draining onto built-up- roof areas, fabricate stainless steel splash pans and bed in hot bitumen.

FF. Termination Bar: ASTM A 276, type 304 or 316 stainless steel, 1-inch wide by 3/16-inch thick, pre drilled holes inches on center as required, no burrs.

GG. Weep Vent: Provide UV-resistant polyester mesh weep hole vent, Color; match adjacent mortar (Weep Vent by Mortar Net USA, 800-664-6638).

HH. Pitch Pockets: Roof penetrations will be flashed with preformed flexible flashings (stainless steel) using clamps and tents, unless the penetration is such a complex shape or size dimension that a pitch pocket is required. Place pourable sealer in all pitch pockets.

2.03 FABRICATION GENERAL

A. General Metal Fabrication: Field verify dimensions and provide factory manufactured components to greatest extent possible. Comply with details shown and with applicable requirements of SMACNA “Architectural Sheet Metal Manual” , 6th edition 2003, and other recognized industry practices. Fabricate for waterproof and weather-resistant performance, with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet metal work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.

B. Provide 4-inch-wide flanges for setting on roofing membrane with concealment by composition stripping.

C. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. Tin edges to be seamed, form seams, and solder. Rivet joints for additional strength where required. Use 1inch standing seams where indicated on drawings (parapet and expansion joint caps).

D. Expansion Provisions: At locations where specific information for metal expansion joints is not specified, provide drive cleat expansion joint or alternate permanently watertight expansion joint approved by the PGCPS Contract Representative and Architect/Engineer. Spacing between expansion joints shall be a maximum of thirty feet. At bends in metal flanges, to receive drive cleat, solder fill pieces watertight at corners. (Note that expansion joints must be installed 30 feet on center even when drawings state to solder joints watertight.)

E. Sealant Joints: Where movable , nonexpansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.

F. Separations: Provide for separation of metal from noncompatible or corrosive substrates such as treated lumber by covering concealed surfaces at locations of contact, with sheet membrane. Note: install sheet membrane even if NOT shown on Drawing.

G. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.

H. Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, noncorrosive metal recommended by sheet metal manufacturer.

1. Size: As recommended by SMACNA manual or sheet metal manufacturer for application, but cleat shall never be less than one gage heavier than metal being secured.

I. Fabricate penetration sleeves with minimum 10-inch high stack, of diameter 1 inch larger than penetrating element.

J. Seams (stainless steel): Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder. Use 1inch standing seams where indicated on drawings (expansion joint caps or

covers).

K. Seams (aluminum): Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Cover joints with 5 inch wide strip of sheet membrane and 6 inch wide cover plates. Rivet joints where necessary for strength. Use 1inch standing seams where indicated on drawings (parapet and expansion joint caps or covers).

L. Do not use graphite pencils to mark metal surfaces.

2.04 SHEET METAL FABRICATIONS

A. Z flashing: Fabricate from 0.040 inch thick prefinished aluminum to profiles shown on Drawings.

B. Receiver: Fabricate from 0.018 inch thick stainless steel prefinished to profiles shown on Drawings.

C. Counter Flashing: Fabricate from 0.018 inch thick stainless steel and prefinished 0.040 aluminum as shown on Drawings.

D. Drip Edge: Fabricate from 0.040 inch thick prefinished aluminum to profiles shown on Drawings.

E. Fascia: : Fabricate from 0.040 inch thick prefinished aluminum to profiles shown on Drawings.

F. Closures: Field verify dimensions and fabricate closure pieces from 0.018 inch thick stainless steel as shown on the Drawings or to match existing. Solder all joints watertight. Paint exposed metal to match adjacent prefinished metal l cover with prefinished metal.

G. Copings: Fabricate from 0.040 inch thick prefinished aluminum as indicated on Drawings or to standard profiles if not shown. Provide mitered, riveted, and sealed corners and sections. Fabricate so outside vertical face of corners is continuous with no cuts. Fabricate and provide 12 inch wide concealed backup plates and 6 inch wide cover plate. At corners, cover plate needs only to extend one inch onto outside face of coping.

H. Conduit and Pipe Enclosures: Fabricate from 0.018 inch thick stainless steel with locked and soldered joints, except where noted to provide locked joints only. Profiles indicated on Drawings or Shop Drawings approved by the Architect/Engineer where not indicated.

I. Cap Flashing: General: Field verify dimensions and fabricate from .018 inch thick stainless steel as shown on drawings.

J. Scuppers and Overflow Scuppers: Field verify dimensions and fabricate from stainless steel as shown on the Drawings. Solder all joints watertight. At building exterior, cover exposed stainless steel with pre-finished metal (matching the adjacent prefinished metal color). Lock cover over cleat and fasten top with two fasteners. Paint any remaining exposed stainless steel to match prefinished metal color.

K. Spoutheads: Replacement Spoutheads will be stainless steel.

L. Gutters: New gutters shall be 6" fabricated from a minimum .032 sierra- tan aluminum to match new roof perimeter components. Downspouts are to be made from .040 aluminum. Gutters shall be installed with hidden brackets which are to be installed every 24 inches.

M. Downspouts: Fabricate new downspouts with shop formed sierra-tan aluminum. Replace damaged or broken cast iron boots with new to match existing. Provide new pre-cast concrete splash blocks where indicated or required .

N. Vent Pipes: Fabricate vent pipe boots and caps from 4 pound lead sheet as shown on the Drawings. Solder Edge Metal and flashing metal greater than 8 inches tall shall be fabricated out of multiple pieces of sheet metal with each piece not exceeding 8 inches in height.

O. Pitch Pockets: Roof penetrations will be flashed with preformed flexible flashings (stainless steel) using clamps and tents, unless the penetration is such a complex shape or size dimension that a pitch pocket

is required. A pourable sealer is to be placed in all pitch pockets.

P. The use of the words "pitch pocket" in the specification will not excuse the contractor from constructing and installing the preformed flexible flashing.

1. Pitch pockets, if approved, will be installed in all locations that exist and in locations that may have been omitted but are needed.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with installer present, to verify locations, dimensions and other conditions affecting performance of the work.

1. Verify compliance with requirements for installation tolerances of substrates.

2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

B. For the record, prepare written report, endorsed by the Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 WOOD BLOCKING INSTALLATION

A. Reuse existing perimeter wood blocking where indicated. Prior to installing new wood blocking, grout cores of CMU solid and install anchor bolts spaced 32 inches on center, except space bolts 16 inches on center within 15 feet of corners.

B. Rip standard size wood blocking as required to fit openings, to form specified conditions and to provide flush surfaces to receive roofing components. Fasten blocking as indicated on Drawings and to comply with current building code requirements.

C. Cover all wood blocking with rubberized asphalt sheet membrane immediately after installing blocking. and before cladding with aluminum components.

D. Wood Blocking:

1. Existing conditions and new construction dictate that new wood blocking is required for numerous details. Fasten blocking as indicated on Drawings and to comply with current Building Code requirements. At a minimum, fasten wood blocking to adjacent wood blocking with nails, 12 inches on center staggered. Within 8 feet of corners, fasten 6 inches on center, staggered. Secure blocking with screws where shown on Drawings. All fastening conditions must comply with Factory Mutual Data Sheet 1-49.

2. Install new wood blocking on existing curbs or install new wood curbs so that top of base flashing will be 10 inches above membrane surfaces. Where new wood curbs exceed 11 inches in height, Contractor may substitute wood stud walls with ¾ inch plywood faces for solid wood curbs.

3.03 UNDERLAYMENT INSTALLATION

A. General: Install underlayment as indicated on Drawings.

B. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Apply primer recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses.

C. Where metal is to be installed directly on cementitious or wood substrates, install sheet membrane even if not shown on drawings.

3.04 INSTALLATION, GENERAL

A. General: Except as otherwise indicated, comply with Manufacturer's installation instructions and recommendations and with SMACNA "Architectural Sheet Metal Manual" Review Thickness of sheet metal to be installed and confirm that proposed thickness meets or exceeds minimum thickness required by SMACNA. Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weatherproof.

B. Install exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

C. Remove and reinstall ducts and/or curbs on the roof as needed to install sheet metal flashing. Coordinate shutdown of equipment with Owner's Representative.

D. Torch cutting of sheet metal flashing and trim is not permitted.

E. Do not use Graphite pencils to mark metal surfaces.

F. Priming: Prime metal surfaces and allow primer to dry before contacting metal with asphaltic materials.

G. Metal Flanges: Bed Flanges of work in bituminous roofing membrane where required for waterproof performance.

H. Roof Edge Flashings: Secure metal flashings at roof edges according to FM Loss Prevention Data Sheet 1-49.

I. Expansion Provisions: Provide for thermal expansion of exposed sheet metal Work. Space movement joints at maximum of 10 feet with no joints allowed 24 inches of corner intersection. At locations where specific information for metal expansion joints is not specified, provide drive cleat expansion joint or lap metal four inches, cover with a five inch wide piece of sheet membrane and protect membrane with a six inch cover plate as approved by the Architect /Engineer. Spacing between expansion joints shall be a maximum of 30 feet. At bends in metal flanges to receive drive cleat, solder fill pieces watertight at corners.

J. Fastener Sizes: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4 inches for nails and not less than ¾ inch for wood screws. Use fasteners of sizes that will penetrate metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

K. Seal joints as required for watertight construction.

1. Sealant-filled joints will not be used. If such joints are encountered, substitute stainless steel flashing for existing/specified metal and solder the joints watertight as described below.

L. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches, except reduce pre-tinning where pre-tinned surface would show in completed work.

1. Do not solder aluminum sheet.

2. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3. Stainless-Steel Soldering: Tin edges of uncoated sheets using solder recommended for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

M. Rivets: Rivet joints in where indicated and where necessary for strength.

3.05 FLASHING INSTALLATION

A. Counterflashing: Fasten counterflashing to receivers with stainless steel screws with neoprene washers, 24 inches on center. Lap sections 4 inches minimum.

B. Vent Pipes: All roof penetrations will be sealed with the manufacturer's warranted liquid flashing system designed specifically for use with the type of roof penetration. Only the manufacturer's roof penetration detail will be accepted. The manufacturer's 20 year NDL warranty will include the liquid drain flashing system at roof penetrations. Confirmation of inclusion in the NDL warranty will be required at time of scope review. Penetrations not suitable for liquid flashing must be flashed per NRCA guidelines. All ductwork penetrations will include curbs. If vent pipes require extending pipes above the roof surface then:

1. Vent pipes shall be reflashed with new four (4) pound lead collars, turned down three inches, and shall be installed over all four (4) plies of roof mat. Prior to installation of roof mat, patch opening between projection and deck edge with oakum or like material to provide even surface and prevent dripping of hot asphalt into interior of building. If the lead collar is too short for the vent pipe, install a lead cap that is formed to have a standing seam channel locking action when squeezed.
2. After installation of lead collars, embed three (3) overlapping plies of reinforcing glass fiber flashing, cut to fit neatly around projections, into uniform solid mopping or hot asphalt at a rate of 30 pounds per 100 square feet. Apply asphalt surface coat and gravel up to base of projection caps and gooseneck where existing shall be replaced upon completion.

C. Pitch Pockets: are to be avoided if possible. Roof penetrations will be flashed with preformed flexible flashings (stainless steel) using clamps and tents, unless the penetration is such a complex shape or size dimension that a pitch pocket is required.

1. The use of the words "pitch pocket" in the specification will not excuse the contractor from constructing and installing the preformed flexible flashing.
2. Pitch pockets, if approved, will be installed in all locations that exist and in locations that may have been omitted but are needed.
3. Place pourable sealer in all pitch pockets.

D. Penetration collars (umbrella type) are to be watertight and made of stainless steel.

1. Band and caulk around roof penetration.

E. Roofing Expansion Joint Curbs:

1. Install wood cur as shown on the Drawings. Install membrane and flashings, then cover top of curb with rubberized asphalt sheet membrane. Fabricate and install continuous cleat and expansion joint cover. Fasten continuous cleat with stainless steel nails spaced 16 inches on center. Lock cover with as shown on Drawings. Fasten other side of cover with screws with neoprene washers, 24 inches on center.
2. Where expansion joint intersects or runs parallel with walls, provide stainless steel end dam/closures extending up under coping or counterflashing. Solder all joints watertight. Fasten vertical leg to wall with stainless steel nails (wood), screws (metal) or Nailins (masonry) spaced 16 inches on center. Cover vertical leg with roofing base flashing, coping or counterflashing as shown on the Drawings.
3. All terminations shall be made watertight without relying on sealant. Where a particular detail is not provided, provide a shop drawing and obtain the Architect's/Engineer's approval for the proposed flashing detail. Prime and paint all stainless steel exposed to view from the ground.
4. The top of all expansion joint curbs must be a minimum of 8" above the finished roof surface.

F. Cap Flashing: Install treated wood nailers, plywood cap, membrane and flashing for wood support curb as shown on the Drawings. Cover plywood with sheet membrane and lap top of base flashing all around. Fabricate stainless steel cap flashing with flat locked and soldered seams and place over curb. Fasten entire perimeter with stainless steel screws with neoprene washers spaced 24 inches on center as shown on Drawings. Where units to be set on new curb are required to be secured, fasten through sheet metal through a full bed of sealant.

G. Drip Edge:

1. Install wood nailers/blocking as shown on Drawing and fasten in accordance with Factory Mutual Data Sheet 1-49. After membrane installation, field verify dimensions, fabricate drip edge and install as shown on Drawings. Fasten outside continuous cleat with stainless steel nails (wood), stainless steel screws, (metal) or Nailins (masonry), spaced 12 inches on center or as shown on approved Manufacturer's Shop Drawings. Provide full ¾ inch lock at cleat. Install drip edge in full bed of rubberized asphalt and fasten 4 inch flange to wood nailer with stainless steel nails spaced 3 inches on center staggered. At joints, install a 12 inch wide back-up plate and gravel stop sections centered over backup plate with ¼" gap between sections: then, install rubberized sheet membrane stripping and 6 inch wide cover plates embedded in mastic and nailed through the opening between the drip edge sections. Inspect to ensure the drip edge is uniform in appearance and has no oil canning, dings, or warps. Replace defective sections prior to installing stripping. Prime metal and install membrane stripping.
2. Prefabricate corners and ends in shop with mitered and soldered joints. Form outside corners by cutting roof side flange and bending drip edge fascia around corner. Rivet flanges where lapped and solder watertight. At inside corners, fabricate and install corner section with mitered . riveted and soldered joints. At ends against vertical surfaces, install a stainless steel end dam with soldered joints, strip in with sheet membrane and install 6 inch wide cover plate covering as much stainless steel as possible. Solder all joints in the end dam watertight and extend a minimum of 4 inches away from drip edge against the vertical surfaces. Cover end dams with counterflashing or other flashing as required.
3. All terminations shall be made watertight without relying on sealant. Where a particular detail is not provided, provide a Manufacturer's Shop Drawing for the proposed detail to be installed. Flashings must be installed similar to those shown on drawings.

H. Expansion Joints:

1. Install wood curbs/stud walls and plywood to provide a minimum eight inches clearance between Roof membrane and top of curbs as shown on the Drawings. Install membrane and flashings. Fabricate and install expansion joint cleats and covers. For covers, use standing seam joints a minimum of 1" high. Install peel & stick membrane on all wood slope cover ½ inch minimum shed water.
2. At fascia cover expansion joint terminations, fabricate fascia cover from stainless steel, with soldered end dam as shown on drawings or follow SMACNA guidelines and Roofing Manufacturer's installation details. Prime metal and strip in closure/fascia cover with two felts and mineral surfaced cap sheet set in hot bitumen. Paint exposed stainless steel to match prefinished metal. Paint exposed metal to match fascia cover or cover with prefinished metal.
3. Where the curb terminates at a corner, provide a single closure piece (all joints soldered watertight) with a 2 inch v -crimp to allow for expansion.
4. Where expansion joints terminate at counterflashings, slope wood curb/stud wall down (if necessary) and provide stainless steel end dam/closures extending up under counterflashing. Solder all joints watertight. Solder one inch high diverter as required to divert to channel water away

from the termination.

5. All terminations shall be made watertight without relying on sealant. Where a particular detail is not provided, follow SMACNA guidelines and Roofing Manufacturer's installation details.

6. The top of all expansion joints must be a minimum of 8" above the finished roof surface.

I. Painting: Remove all rust., dirt, cement and other materials incompatible with painting system, in accordance with paint Manufacturer's specifications and recommendations, for all stainless steel surfaces to be painted. Apply primer and two coats of paint to prepared surface in accordance with paint manufacturer's specifications and recommendations.

J. Exhaust Fans/Vents: Disconnect and raise mechanical equipment to allow installation of additional blocking and base flashing as necessary. Fasten wood blocking to existing integral wood blocking to provide 12 inches of clearance between the membrane and the top of the flashing. Obtain inside access to extend electrical conduit and provide duct extensions as required to raise units. Install wood blocking and flashings as shown on the Drawings or in accordance with standard industry practice if not shown. Reinstall and reconnect mechanical equipment so units function equal to or better than the operating condition prior to disconnection. All mechanics performing electrical and mechanical work must be licensed to perform work in the State (Maryland) where the facility is located and approved by the Owner.

K. Fascia/Fascia Cover:

1. Install wood nailers/blocking shown on Drawing and fasten in accordance with Factory Mutual Data Sheet 1- 49. After membrane installation, field verify dimensions, fabricate fascia covers and fascias, and install as shown on Drawing. Fasten outside continuous cleat for fascia with stainless steel nails spaced 12 inches on center . Lock bottom of fascia over cleat with full ¾ inch lock and fasten top edge with stainless steel nails spaced 16 inches on center. Double the quantity of nails screws within 15 feet of corners. Install fascia cover in full bed of roofing cement and fasten 4" flange to wood nailer with stainless steel nails spaced 3 inches on center staggered. Provide ¼ inch gap between fascia cover sections. Install 5 inch wide strip of sheet membrane and 6 inch wide top cover plate embedded in mastic and nailed through the opening between the fascia cover sections. Inspect to ensure the fascia cover is uniform in appearance and has no oil canning, dings, or warps. Replace defective sections prior to installing stripping.

2. Form outside corners by cutting roof side flange and bending fascia cover around corner. Rivet flanges where lapped and seal with sealant. At inside corners, fabricate and install corner section with mitered, pop riveted and sealed joints. At ends against vertical surface, provide a stainless steel end plate soldered watertight and extending a minimum 4 inches away from gravel stop against the vertical surfaces as shown on approved Shop Drawings. Cover end dams with counterflashing or other flashing where indicated on Shop Drawings. All terminations should be made watertight without relying on sealant. Where a particular detail is not provided, provide a shop drawing for the proposed detail to be installed. Flashings must be installed similar to those shown on drawings.

3. For Roofing Manufacturer's factory fabricated perimeter metal systems, follow Roofing Manufacturer's instructions and details. Most PGCPS facilities will have a wood cant gravel stop and a Two- piece, factory fascia system. Each fascia, upper and lower will have a continuous cleat. The top cover will also be a cleat for the upper fascia. SEE Contract Drawings and provide Roofing Manufacturer's fascia system as shown

4. Fascia will be stucco-embossed aluminum.

L. Multiple Conduit Enclosures: Disconnect existing conduit and refrigerant lines (if necessary) as required to reroute conduit and refrigerant lines to configurations shown on drawing. Install wood nailers, membrane and flashing for conduit enclosures as shown on the Drawing. Fasten wood curbs to the deck

with screws or toggle bolts, minimum two per side. Install curbs to provide 10 inch minimum vertical clearance above the finished membrane. Reinstall electrical conduit and refrigerant lines to original configuration. Field verify dimensions and install stainless steel counterflashing and enclosure as shown on Drawing. Solder all joints, except as noted. Reinstall and reconnect conduit and refrigerant lines so units function in accordance with or better than the operating condition stated in the report at the start of the project. Provide a second written report as stated below.

M. Single Rigid Conduit Penetrations: Reroute and flash all individual, rigid conduit penetrations with stainless steel boots and rain shields as shown on the Drawings or as required. Extend conduit as required to install boot with 10” vertical flange. Set flange of boot in a full bead of roofing cement. Prime flanges of boots and install two -ply stripping.

N. Equipment Recertification: Reinstall and reconnect all conduit and refrigerant lines so all types of units function in accordance with or better than the operating condition stated in the report at the start of the project. Provide a second written report co-signed by the Owner’s representative, the Roofing Contractor’s Representative and the Mechanical Subcontractor’s representative stating the operating conditions of each unit and the condition of the conduits/lines feeding the units following completion of work. After units are reconnected and properly functioning, install batt insulation and conduit/wiring enclosure as shown on the Drawing or as required. All mechanics performing electrical and mechanical work must be licensed in the State where the facility is located (Maryland) and approved by the owner.

O. If Re-using Existing Coping: (Re-use as opposed to replacement must be specified in Scope of Work).

1. Mark each coping piece with a unique designation and then remove and store the existing coping for reinstallation. After membrane and base flashing installation, Install sheet membrane under coping and reinstall coping pieces in the exact locations from where they were removed. Reinstall cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.

2. Coping Joint Covers: Provide new metal (match coping) plate under each joint. The plate shall be 12 inches wide and extend at least 3-inches down the inside and outside faces of the wall . After coping installation, install a 5-inch wide piece of sheet membrane over the coping joint and then reinstall the joint covers.

P. Painting: Remove all rust, dirt, cement and other materials incompatible with painting system, in accordance with paint manufacturer’s specifications and recommendations, from all exposed existing ferrous metal surfaces to remain (HVAC Units, exhaust fans, etc.) and from stainless steel surfaces to be painted. Apply primer and two coats of paint to prepared surfaces in accordance with paint Manufacturer’s specifications and recommendations

Q. Counterflashing in Brick Masonry: Reuse existing counterflashing receiver if in good condition and at required height. If existing receiver is damaged or otherwise unreusable, saw cut a 1 ½ inch deep reglet in the mortar joint about 3 inches or as needed above the top of the existing wall flashing. Cut the joint at a 15 degree angle and install a stainless steel counterflashing receiver extending 1 ½ inches into saw cut mortar joint. Secure receiver with lead wedges , spaced 10 inches on center. Lap and solder joints watertight. Provide for expansion every 30 feet by lapping joints and covering with 5 inch wide strip of sheet membrane and a 6 inch cover plate. After flashing installation, repoint reglet with mortar. Provide cotton wick weeps with two inch wide, L-shaped metal covers, 24” on center. Metal covers to be fabricated from same material as flashing receiver.

1. Replacement counterflashing metal shall be, stainless steel, or aluminum mill or Kynar finish, stucco-embossed aluminum, or copper as specified.

    a. Clean out reglet before replacing flashing.

2. New reglets and counter flashing will be installed when specified. On masonry walls, the mortar joint will be cut out and a new stainless steel or aluminum reglet installed.
3. In areas where a reglet cannot be installed, a Philadelphia-type counterflashing may be allowed by the Board's representative with prior approval. This counter flashing will have multiple bends for caulk and an aluminum stiffener strip. The stiffener strip will be predrilled and have the dimensions of 1" wide x 3/16" thick.
4. Do not compromise (cover) existing through-wall flashing systems that are designed to weep internal wall moisture.

R. Masonry Control Joints: At_____, remove the existing sealant and backer rod from the masonry control joints from the top of the parapet to the wall flashing below. Use grinders as required to remove all existing sealant. Then, prime the masonry and install backer rod and sealant in accordance with manufacturer's recommendations.

S. Overflow Scuppers:

1. Provide completely soldered stainless steel overflow scuppers through parapets or perimeter cants as shown on the Drawings. Locate bottom of scupper no more than five inches above membrane surface at locations shown on Drawing or as required to comply with current code. Fasten flanges of scupper liners to the masonry/concrete with Nailins, or to metal/wood blocking with stainless steel screws. At the exterior of the parapet. Extend the outside scupper flange under fascia/coping or install a new piece of stainless steel or prefinished aluminum flashing extending from under the coping and lapping the top of the scupper a minimum of 3 inches. Secure the bottom of the flashing with a continuous cleat and secure the top with 3 nailins or screws. Prime metal and strip in roof side scupper flanges. Cover both ends of each scupper opening with hardware cloth soldered to the scupper. Wrap exposed outside scupper flanges with prefinished aluminum so scupper matches color of fascia. At masonry walls where the top of the scupper is more than 12 inches from the top of the parapet, install a counterflashing (matching coping material) in a 1 ½ inch deep saw cut reglet. Extend counterflashing 4 inches beyond ends of scupper flanges. a. Extend scupper pan at least 2" past face of wall.
2. Scupper Drains: Provide completely soldered stainless steel scupper drains through parapets or perimeter cants as shown on the Drawings. Locate bottom of drain at base insulation height for optimum drainage at locations shown on Drawing or as required as an auxiliary drain. Taper/sump the insulation as required to ensure positive drainage. Fasten flanges of scupper liners to the masonry/concrete with Nailins, or to metal/wood blocking with stainless steel screws. At the exterior of the parapet. Extend the outside scupper flange under fascia/coping or install a new piece of stainless steel or prefinished aluminum flashing extending from under the coping and lapping the top of the scupper a minimum of 3 inches. Secure the bottom of the flashing with a continuous cleat and secure the top with 3 nailins or screws. Prime metal and strip in roof side scupper flanges. Cover both ends of each scupper drain opening with hardware cloth soldered to the scupper. Wrap exposed outside scupper flanges with prefinished aluminum so scupper matches color of fascia. At masonry walls where the top of the scupper is more than 12 inches from the top of the parapet, install a counterflashing (matching coping material) in a 1 inch deep saw cut reglet. Extend counterflashing 4 inches beyond ends of scupper flanges. Provide scupper box and downspout fabricated from prefinished aluminum. See detail on drawing. Use SMACNA design detail for scupper box.

T. Minimum Overflow Scupper Dimensions:

1. Serving 6" roof drain or multiple drains: No less than 8" wide x 4" tall or 32 S.I. (square inches)
2. Serving 5" roof drain or multiple drains: No less than 6" wide x 4" tall or 24 S.I

3. Serving 4” roof drain or multiple drains: No less than 6” wide x 3” tall or 18 S.I.
4. Serving 3” roof drain or multiple drains: No less than 4” wide x 3” tall or 12 S.I.

U. Spoutheads: In stall spoutheads where shown on Drawing.

V. Gutters: Gutters shall be installed with hidden brackets which are to be installed every 24 inches. Coordinate gutter installation with downspout locations. When possible, provide a minimum pitch and install gutters in straight runs so that the gutter flow is toward the downspout(s) without ponding at gutter midpoint. Seal all gutter downspout penetrations and caps.

1. New gutters will receive downspouts as indicated or per code requirement.
2. Match the gutters with the metal for the fascia etc. Typically, Sierra Tan gutters and downspouts are specifically called for in the individual job description.

W. Downspouts: Fabricate and install downspouts in locations shown on Drawings. Fabricate gutter attachment straps to match gutters.

1. The downspout size will match the existing on-site dimensions. Seal around the downspout at the boot connection. Downspouts will be installed one-for-one with all straps per code. New gutters will receive downspouts as indicated or per code requirement.
2. Use a Pittsburgh lock-seam to form downspouts.

X. Flashing Receivers:

1. At locations indicated on site or on Drawings, remove and discard existing equipment, supports and metal flashings.

Y. Z- Flashing Receiver: Install z-flashing receiver with 4 inch vertical leg on wall sheathing as shown on Drawings. Fasten vertical leg to backup wall with stainless steel screws (wood or metal) spaced 16 inches on center. For prefinished aluminum, lap joints and cover with a 5 inch wide strip of rubberized asphalt sheet membrane and a 6 inch wide cover plate. For stainless steel, lap, rivet, and solder all joints watertight. Strip vertical leg to wall with sheet membrane.

3.06 CLEANING AND PROTECTION

A. Clean and neutralize flux materials. Clean off excess solder.

B. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer’s written installation instruction. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar repair procedures.

END OF SECTION

SECTION 07 7100
MANUFACTURED ROOFING SPECIALTIES

PART 1 - GENERAL

1.01 GENERAL

A. Where required in the job description, provide and install:

1. New painted galvanized steel roof access scuttles.
2. New telescopic roof hatch access ladder safety posts at roof scuttle locations.
3. Replacement and additional new aluminum rooftop roof access ladders.

PART 2 - PRODUCTS

2.01 ROOF ACCESS SCUTTLES

A. Where required in the job description, provide and install heavy-duty roof access scuttles. This unit or units will be new and manufactured by the Bilco Company of New Haven, Connecticut. Orientation of hatches shall be approved by the PGCPS Contract Representative prior to installation and shall allow safe usage of the ladder system.

B. Roof Scuttle Specifications:

1. Manufacturer: Bilco
2. Model: Type "S"
3. Hardware: Stainless Steel
4. Lifting Mechanisms: 2 each/one on each corner of hinge side.
5. Cover and curb: 14 gauge painted galvanized steel
6. Cover liner: 14 gauge painted galvanized steel
7. Insulation: 1 inch fiberglass
8. Curb height: 12 inches

5.	**COVER AND CURB**	**14 GAUGE PAINTED GALVANIZED STEEL**
6.	**COVER LINER:**	**14 GAUGE PAINTED GALVANIZED STEEL**
7.	**INSULATION:**	**1 INCH FIBERGLASS**
8.	**CURB HEIGHT:**	**12 INCHES**

2.02 ROOF ACCESS SAFETY POST

A. Provide and install 3 new BILCO LU-2 galvanized steel “LADDERUP” telescopic safety posts.

B. Attach new safety post to existing roof hatch access ladder located in stairwell per manufacturer’s installation instructions/requirements.

2.03 ROOF WALL LADDERS

A. Where required in the job description, provide and install aluminum wall ladders as made by Precision Stair Corporation and LYNN Ladders. Follow manufacturer's installation instructions and comply with all OSHA/MOSH requirements.

1. Bottom rung to be at twelve (12) inches above the roof elevation or OSHA standard.
2. Center of rungs to be a minimum of 7” from wall
3. Install forty-eight (48) inch handrail above the roofline or OSHA standard if greater.
4. Provide cage on ladders twenty (20) feet long and longer, or as required by OSHA.

5. Provide previously specified walk-pad material at top and bottom of each ladder.
6. Provide equipment style capped curbs at roof for added support/attachment of ladder rails at overhanging roofs that make wall connection brackets exceedingly long and unable to accommodate the weight of the ladder and user.

PART 3 - EXECUTION

3.01 GENERAL

A. Install new heavy-duty roof access scuttles per manufacturer's instructions and recommendations.
   1. Align scuttle properly with scuttle access ladder.
   2. Provide additional wood blocking at roof opening to accommodate added roof insulation. Scuttle curb shall no less than 12 inches above the finished roof surface.
   3. Install new scuttle level and properly aligned on new wood blocking at scuttle opening. Use stainless steel hardware to attach to new treated wood blocking per manufacturer's installation recommendations.

B. Install new "ladder-up safety posts at existing roof scuttle access ladder per manufacturer's instructions and recommendations.
   1. Align scuttle properly with scuttle access ladder.
   2. Provide additional wood blocking at roof opening to accommodate added roof insulation. Scuttle curb shall no less than 12 inches above the finished roof surface.
   3. Install new scuttle level and properly aligned on new wood blocking at scuttle opening. Use stainless steel hardware to attach to new treated wood blocking per manufacturer's installation recommendations

END OF SECTION

SECTION 07 7123
GUTTERS AND DOWNSPOUTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Pre-fabricated aluminum gutters and downspouts.

B. Related Sections include the following:

1. Division 7 Section "Sheet Metal Flashing and Trim" for flashings and other sheet metal work.
2. Division 7 Section "Manufactured Roof Specialties" for fasciae and copings.
3. Division 7 Section "Metal Roof Panels" for metal roofing systems.
4. Division 7 Section "Joint Sealants" for field-applied sealants not otherwise specified in this Section.

1.02 REFERENCES

A. American Architectural Manufacturers Association:

1. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
2. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

B. ASTM International: ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

C. Federal Specification Unit: FS TT-C-494 - Coating Compound, Bituminous, Solvent Type, Acid Resistant.

D. Sheet Metal and Air Conditioning Contractors' National Association, Inc.: SMACNA - Architectural Sheet Metal Manual.

1.03 SUBMITTALS

A. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.

B. Product Data: Submit data on manufactured components, materials, and finishes.

C. Samples: Submit two samples, 24 inches long illustrating component design, finish, color, and configuration.

D. LEED Submittals:

1. Credit MR 4.1 and 4.2: Product Data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
    a. Contributions to this Credit include recycled content aluminum.
2. Coordinate with Construction Waste Management requirements.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with SMACNA Manual; maintain one copy of manual on site.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Stack products to prevent twisting, bending, and abrasion, and to provide ventilation; slope to drain.

B. Prevent contact with materials during storage capable of causing discoloration, staining, or damage.

PART 2 - PRODUCTS

2.01 GUTTERS AND DOWNSPOUTS

A. Available Manufacturers:

1. Berger Building Products Corp.
2. Metal-Era.
3. P. Hickman Company.

B. Product Description:

1. Gutters: SMACNA Rectangular style profile; Figure 1-2, Style F.
2. Downspouts: SMACNA round profile; Figure 1-32A.

2.02 COMPONENTS

A. Pre-Finished Aluminum Sheet:

1. ASTM B209, manufacturer’s standard alloy and temper for specified finish; shop pre-coated with three coat PVDF (polyvinylidene fluoride) coating.
    a. Gutters: 0.050 inch thick.
    b. Downspouts: 0.050 inch thick.
2. Color: Match Architect's sample.

2.03 ACCESSORIES

A. Anchors and Supports: Profiled to suit gutters and downspouts.

1. Anchoring Devices: In accordance with SMACNA requirements.
2. Gutter Supports: Brackets and straps sized per SMACNA Table 1-B.
3. Downspout Supports - Typical: Brackets; SMACNA Figure 1-35E.

B. Strainers: 15 gage stainless steel wire baskets.

C. Fasteners: Aluminum or Stainless steel, with EPDM washers.

D. Protective Backing Paint: FS TT-C-494, Bituminous.

2.04 FABRICATION

A. Form gutters and downspouts of profiles and sizes indicated.

B. Fabricate with required connection pieces.

C. Form sections to shape indicated on Drawings, square, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance; allow for expansion at joints.

D. Hem exposed edges of metal.

E. Fabricate gutter and downspout accessories; seal watertight.

2.05 FACTORY FINISHING

A. PVDF (polyvinylidene fluoride) Coating: Multiple coat, thermally cured, fluoropolymer system conforming to AAMA 2605.

B. Color: Custom to match Architect's sample.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify surfaces are ready to receive gutters and downspouts.

3.02 PREPARATION

A. Paint concealed metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to minimum dry film thickness of 15 mils.

3.03 INSTALLATION

A. Join lengths with formed seams sealed watertight.

B. Support Spacing:

1. Gutters:
    a. Brackets: 36 inch o.c.
    b. Straps: 36 inch o.c. offset 18 inches o.c. of bracket locations.
2. Downspouts: SMACNA Figure 1-35.

C. Flash and seal gutters to downspouts and accessories.

D. Slope gutters minimum 1/16 inch per foot.

E. Provide gutter slip joints every 20 feet in length for contraction and expansion; seal joints with sealant of matching color.

F. Set downspouts plumb and not less than 1 inch from the wall.

G. Provide leaders to connect gutters on overhanging eaves to downspouts; set leaders with a slope not less than 1/16 inch per foot or more than 30 degrees below a horizontal line.

H. Fit leaders over the outlet tube in gutter bottom riveted to the downspout; rivet spacing shall be not more than 2 inches.

I. Set strainers loosely in the outlet tube opening in gutter.

J. Make joints between lengths of downspouts by telescoping the end of the upper lengths at least 3/4 inch into the lower length.

END OF SECTION

SECTION 07 7200
ROOF ACCESSORIES

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Roof curbs.
2. Equipment supports.
3. Hatch-type heat and smoke vents; acoustical.
4. Ladder safety post.

1.02 SUBMITTALS

A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details for roof accessories. Show layouts of roof accessories including plans and elevations. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components. Include plans, elevations, sections, details, and attachments to other work.

C. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:

1. Size and location of roof accessories specified in this Section.
2. Method of attaching roof accessories to roof or building structure.
3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.

1.03 QUALITY ASSURANCE

A. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

1.05 PROJECT CONDITIONS

A. Field Measurements: Verify required openings for each type of roof accessory by field measurements before fabrication and indicate measurements on Shop Drawings.

1.06 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers listed in other Part 2 articles.

2.02 METAL MATERIALS

A. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by hot-dip process and prepainted by coil-coating process to comply with ASTM A 755.
   1. Galvanized Steel Sheet: ASTM A 653, G90 coated.
   2. Exposed Finishes:
      a. Roof Curbs, Equipment Curbs and Pipe Supports: Manufacturer's standard powder coat.
      b. Roof Vents: Manufacturer's standard powder coat.

B. Steel Shapes: ASTM A 36, hot-dip galvanized to comply with ASTM A 123, unless otherwise indicated.

2.03 MISCELLANEOUS MATERIALS

A. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, complying with AWPA C2; not less than 1-1/2 inches thick.

B. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

C. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by roof accessory manufacturer. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.

D. Gaskets: Manufacturer's standard tubular or fingered design of EPDM, or PVC; or flat design of foam rubber.

E. Elastomeric Sealant: ASTM C 920, polyurethane sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

2.04 ROOF CURBS

A. Roof Curbs: Provide metal roof curbs, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported on roof curbs. Fabricate with welded or sealed mechanical corner joints, with stepped integral metal cant raised the thickness of roof insulation and integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.
   1. Available Manufacturers:
      a. Custom Curb, Inc.
      b. LM Curbs.
      c. Pate Company (The).
      d. Roof Products & Systems Corporation.
      e. Roof Products, Inc.
      f. ThyCurb; Div. of Thybar Corporation.
   2. Load Requirements: Indicated on Drawings.
   3. Material: Galvanized steel sheet, 14 gage thick.
      a. Finish: High-performance organic coating.
   4. Liner: Same material as curb, of manufacturer's standard thickness and finish.
   5. Factory install wood nailers at tops of curbs.
   6. Factory insulate curbs with 1-1/2-inch thick, glass-fiber board insulation.

7. Curb height may be determined by adding thickness of roof insulation and minimum base flashing height recommended by roofing membrane manufacturer. Fabricate units to minimum height of 10 inches above surface of finished roof, unless otherwise indicated.
8. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units.

2.05 EQUIPMENT SUPPORTS

A. Equipment Supports: Provide metal equipment supports, internally reinforced and capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported. Fabricate with welded or sealed mechanical corner joints, with stepped integral metal cant raised the thickness of roof insulation and integral formed mounting flange at perimeter bottom. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1. Available Manufacturers:
    a. Custom Curb, Inc.
    b. LM Curbs.
    c. Pate Company (The).
    d. Roof Products & Systems Corporation.
    e. Roof Products, Inc.
    f. ThyCurb; Div. of Thybar Corporation.
2. Load Requirements: Indicated on Drawings.
3. Material: Galvanized steel sheet, 14 gage thick.
    a. Finish: High-performance organic coating.
4. Factory-install continuous wood nailers at tops of equipment supports.
5. Metal Counterflashing: Manufacturer's standard removable counterflashing, fabricated of same metal and finish as equipment support.
6. Fabricate units to minimum height of 12 inches, unless otherwise indicated.
7. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curb units with water diverter or cricket and with height tapered to match slope to level tops of units.

2.06 LADDER SAFETY POST

A. Furnish and install at all roof hatch ladders a ladder safety post. The ladder safety post shall be pre-assembled from the manufacturer.

1. Basis-of-Design: Bilco Model LU-1.

B. Performance characteristics:

1. Tubular post shall lock automatically when fully extended.
2. Safety post shall have controlled upward and downward movement.
3. Release lever shall disengage the post to allow it to be returned to its lowered position.
4. Post shall have adjustable mounting brackets to fit ladder rung spacing up to 14” on center and clamp brackets to accommodate ladder rungs up to 1-3/4” in diameter.

C. Post: Shall be manufactured of high strength square tubing. A pull up loop shall be provided at the upper end of the post to facilitate raising the post.

D. Material of construction: Shall be steel.

E. Balancing spring: A stainless steel spring balancing mechanism shall be provided to provide smooth, easy, controlled operation when raising and lowering the safety post.

F. Hardware: All mounting hardware shall be Type 316 stainless steel.

G. Finishes: Factory finish shall be yellow powder coat.

2.07 HEAT AND SMOKE VENTS - ACOUSTICAL

A. Hatch-Type Heat and Smoke Vents: Manufacturer's standard double-leaf, hatch-type heat and smoke vents with integral double-wall insulated curbs and frame, with welded or sealed mechanical corner joints, integral condensation gutter, and cap flashing. Fabricate with insulated double-wall lid, continuous weathertight perimeter lid gaskets, and equip with automatic self-lifting mechanisms, UL-listed fusible links rated at 165 deg F, and corrosion-resistant or hot-dip galvanized hardware including hinges, hold-open devices, and independent manual-release devices for inside and outside operation of lids; unit to be provided with winch operated manual remote to be located on Stage - final location to be coordinated.

1. Basis-of-Design: Nystrom SVG-Steel Acoustical Smoke Vent - STC 45 Motorized.
2. Loads: Fabricate heat and smoke vent to withstand a minimum 40-lbf/sq. ft. external live load and 30-lbf/sq. ft. uplift.
    a. When release is actuated, lid shall open against 10-lbf/sq. ft. snow or wind load and lock in position.
3. Regulatory Requirements: UL 793 and NFPA 204.
4. Heat and Smoke Vent Compliance: Provide units that have been tested and UL listed.
5. Fire Resistance of Lids: UL Class A rating.
6. Integral Curb, Framing, and Lid Material: Galvanized steel sheet, 0.079 inch thick.
    a. Finish: Powder coat.
7. Insulation: Glass-fiber board.
8. Fabricate integral curbs to minimum height of 12 inches, unless otherwise indicated.
9. STC Rating: Minimum 45.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.

1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored and is ready to receive roof accessories.
2. Verify dimensions of roof openings for roof accessories.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Install roof accessories to fit substrates and to result in watertight performance.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Underlayment: Where installing exposed-to-view components of roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene underlayment.

2. Bed flanges in thick coat of asphalt roofing cement where required by roof accessory manufacturers for waterproof performance.

D. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.

E. Roof Curb Installation: Set roof curb so top surface of roof curb is level.

F. Equipment Support Installation: Set equipment support so top surface of equipment support is level.

G. Seal joints with elastomeric sealant as required by manufacturer of roof accessories.

3.03 CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions.

END OF SECTION

SECTION 07 7233
ROOF HATCHES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General Conditions and other Division 1 Specification Sections, apply to the Work of this Section.

1.02 RELATED WORK

A. Section 07510 – 4 ply Built-up Roofing with Gravel Ballast and Insulation.

B. Section 16620 - Security Intrusion System.

1.03 SUBMITTALS

A. Submit shop drawings indicating materials, methods of fabrication and requirements for anchoring to adjacent and supporting construction.

B. Submit manufacturer’s product data, including catalog sheets and technical information.

1.04 WARRANTY

A. Provide five (5) year written guarantee on installation labor.

B. Provide ten (10) year written guarantee on roof hatch.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Babcock –Davis (www.babcockdavis.com): Model BRHPA – 3’-0”X2’-6”

B. Bilco (www.bilco.com): Type S-50 - 3'-0" x 2' x 6".

C. Milcor, Inc. (www.milcorinc.com): Type RD-1 - 3'-0" x 2'-6".

D. Dur-Red Products (www.dur-red.com): LH-A - 3'-0" X 2'-6".

E. Other manufacturers, pre-bid approved in accordance with Section 01630, shall be acceptable.

2.02 PRODUCT DESCRIPTION

A. Product Features:

1. Cover and Liner: .090 Aluminum (11 GA) cover and .040 Aluminum liner.
2. Frame: .090 Aluminum, 12 high, with 3 ½” wide mounting flange
3. Insulation Core: 1” rigid fiberglass for cover and curb perimeter.
4. Cover Operation: Torsion bar spring, concealed in telescoping tube, and contained within the confines of the hatch.
5. Hold-open Arm: Automatically locking, with grip handle
6. Latching Device: Spring latch with exterior and interior turn handles
7. Hinges: Zinc plated steel tamper proof hinge assembled on the inside of the hatch as part of spring assembly
8. Padlock hasp mounted on inside of hatch
9. Weatherseal: Closed-cell rubber.
10. Hardware Finish: Zinc plated.

2.03 SAFETY RAILING SYSTEM

A. Provide roof hatch manufacturer’s standard roof hatch safety railing system, compatible with hatch size specified. Safety railing shall comply with OSHA Fall Protection Regulation 29 FR 1910.23.

PART 3 - EXECUTION

3.01 INSPECTION

A. Inspect the locations where hatch(es) shall be installed. Verify that openings are properly constructed, and that adjacent supporting substrates are clean, dry and free of foreign matter. Notify Owner’s Representative and Architect if any adverse conditions are encountered that would interfere with proper installation. Do not proceed until such conditions have been corrected.

3.02 INSTALLATION

A. Install hatch(es) in accordance with manufacturer's written installation instructions. Securely attach to supporting substrates.

B. Hatch(es) shall be provided with security intrusion switch connected to building Security Intrusion system as part of the work of Division 28.

END OF SECTION

SECTION 07 8400
FIRESTOPPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of all joints and penetrations in fire-resistance rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

C. Smoke seals.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

1.03 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

B. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

C. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc..

D. FM 4991 - Approval of Firestop Contractors; Factory Mutual Research Corporation.

E. FM P7825 - Approval Guide; Factory Mutual Research Corporation.

F. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc..

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.

C. Product Data: Provide data on product characteristics, performance ratings, and limitations.

D. LEED Report: Submit VOC content documentation for all adhesives, sealants and primers.

1. Comply with VOC content limits of Section 01 61 16.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Qualification statements for installing mechanics.

1.05 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the specified fire ratings when tested in accordance with ASTM E 814 and ASTM E 119.

1. Listing in the current-year classification or certification books of UL, FM, or ITS (Warnock Hersey) will be considered as constituting an acceptable test report.

2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.

B. Installer Qualifications: Company specializing in performing the work of this section and:

1. Approved by Factory Mutual Research under FM Standard 4991, Approval of Firestop Contractors, or meeting any two of the following requirements:.

2. With minimum 3 years documented experience installing work of this type.

3. Able to show at least 5 satisfactorily completed projects of comparable size and type.

4. Approved by firestopping manufacturer.

C. Installing Mechanic's Qualifications: Trained by firestopping manufacturer and able to provide evidence thereof.

1.06 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.

B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 - PRODUCTS

2.01 FIRESTOPPING SYSTEMS

A. F-Rated (Flame Rated) Through-Penetration Firestop Systems: Provide through-penetration firestop systems with F ratings indicated as determined per ASTM E814, UL 1479 but not less than that equaling or exceeding the fire resistance rating of the construction penetrated.

B. T-Rated (Temperature Rated) Through-Penetration Firestop Systems: Provide through-penetration firestop systems with T ratings, in addition to F ratings, as determined per ASTM E814, where indicated and where systems protect penetrating items exposed to contact with adjacent materials in occupiable floor areas; T-rated assemblies are required where specified by codes or where the following conditions exist:

1. Where firestop systems protect penetrations located outside of wall cavities.
2. Where firestop systems protect penetrations located outside fire resistive shaft enclosures.
3. Where firestop systems protect penetrations located in construction containing doors required to have a temperature rise rating.
4. Where firestop systems protect penetrating items larger than a 4 inch diameter nominal pipe or 16 square inches in overall cross sectional area.

C. Fire Resistive Joint Sealants: Provide joint sealants with fire resistance ratings indicated, as determined per UL 2079 or (ASTM E1399, E1966 and E2307), but not less than that equaling or exceeding the fire resistance rating of the construction in which the joint occurs.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing materials to arrest liquid material leakage.

3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by authority having jurisdiction.

C. Install labelling required by code.

3.04 FIELD QUALITY CONTROL

A. Provide independent third-party inspection of the installed firestopping after application and prior to its concealment.

B. Repair or replace any damaged areas of firestopping.

3.05 PROTECTION

A. Clean adjacent surfaces of firestopping materials.

B. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 07 8700
SMOKE CONTAINMENT BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Smoke and Fire Curtains:

1. Fixed fabric draft curtains.
2. Fire-protective smoke curtains.
3. Accordion fire-protective smoke curtains.
4. Horizontal fire-protective smoke curtains.

B. Operational controls.

1.02 RELATED REQUIREMENTS

A. Section 07 7200 - Roof Accessories: Smoke and relief vents.

B. Section 21 1300 - Fire-Suppression Sprinkler Systems: Connections with supervisory, alarm, and actuating devices installed in sprinkler system.

C. Section 26 0533.13 - Conduit for Electrical Systems: Conduit from electric circuit to operator and from operator to control station.

D. Section 26 0583 - Wiring Connections: Power to disconnect.

E. Section 28 4600 - Fire Detection and Alarm: Connections with fire alarm and smoke detectors.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2017.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2018b.

C. FM (AG) - FM Approval Guide current edition.

D. ICC-ES AC77 - Acceptance Criteria for Smoke-Containment Systems Used with Fire-resistance-rated Elevator Hoistway Doors and Frames and at the Intersection of Elevator Lobby and Corridor 2013, with Editorial Revision (2017).

E. ITS (DIR) - Directory of Listed Products current edition.

F. NFPA 3 - Recommended Practice on Commissioning and Integrated Testing of Fire Protection and Life Safety Systems 2018.

G. NFPA 4 - Standard for Integrated Fire Protection and Life Safety System Training 2018.

H. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL (DIR) - Online Certifications Directory Current Edition.

J. UL 10D - Standard for Safety Fire Tests of Fire Protective Curtain Assemblies Current Edition, Including All Revisions.

K. UL 263 - Standard for Fire Tests of Building Construction and Materials Current Edition, Including All Revisions.

L. UL 864 - Control Units and Accessories for Fire Alarm Systems Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's technical literature describing product components, connections, operation details, and required electrical equipment.

C. Shop Drawings: Submit shop drawings that include elevations, sections, details and dimensions, materials, finishes, anchorage methods, and hardware locations for specified protective curtains.

D. Certificate: Submit certificate that products of this section meet or exceed applicable requirements and regulations of authorities having jurisdiction .

E. Evaluation Service Reports: Submit report showing compliance with requirements of ICC-ES AC77.

F. Manufacturer's Installation Instructions: Submit instructions that indicate installation sequence, adjustment and alignment procedures.

G. Field Quality Control Submittals: Report of field testing for proper operation of system.

H. Designer's Qualification Statement.

I. Manufacturer's Qualification Statement.

J. Installer's Qualification Statement.

K. Maintenance Contracts.

1. Indicate in proposal the services, obligations, conditions, and terms for agreement period and for renewal options.

L. Operating and Maintenance Manuals: Submit complete set of manuals describing materials, devices and procedures required in operation and maintenance of specified protective curtain system(s).

M. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least five years of documented experience.

C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide 5 year manufacturer's warranty for smoke and fire control curtain system and components.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fixed Fabric Draft Curtains:

1. Door Systems, Inc: www.doorsysinc.com/#sle.

2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 COMPONENTS

A. Protective Curtain: Woven reinforced and coated fabric curtain in compliance with UL 10D and UL 263 fire tests, and with flame spread index of 25 or less and smoke developed index of 50 or less when

tested in accordance with ASTM E84.

1. Fabric and Coating Materials: Manufacturer's standard for application(s) as indicated.
2. Fire Rating: As indicated on drawings.
3. Label: Provide applicable UL (DIR) label affixed to assembly.

B. Roller Assembly: Horizontal structural support with minimal deflection of protective curtain assembly and sized to incorporate motor drive unit.

1. Roller Shape: Manufacturer's standard.
2. Roller Material: Manufacturer's standard.

C. Motor Drive Unit: Motor and gearbox assembly are within hood and connected to roller assembly, with motor control circuiting in metal enclosure mounted on motor end of hood assembly.

D. Mounting Brackets: Plates and brackets for supporting hood assembly.

1. Sheet Metal Thickness: 14 gage, 0.0747 inch (1.9 mm) galvanized steel.
2. Type of Mount: As indicated on drawings.

E. Vertical Guide Assemblies: Side guide rails support each edge of protective curtain with flush configuration having profile not to exceed 3/8 inch (9.5 mm) in width and provided with concealed and internally fitted UL (DIR) approved smoke seals.

2.03 OPERATIONAL CONTROLS

A. Operator, Controls, Actuators, and Safeties: Provide products listed by FM (AG), ITS (DIR), UL (DIR) or testing agency acceptable to authorities having jurisdiction.

1. Operable curtain shall deploy within 10 seconds upon actuation signal from fire alarm system, local smoke detector, sprinkler alarm system or loss of electric power to unit with listed releasing device in compliance with UL 864.

B. Electric Motor: Inboard motor including gearbox assembly, electromechanical travel limit switches linked to electromagnetic brake in compliance with NFPA 70.

1. Power Supply: Provide connection to building's 120 VAC power supply for drive-control system.
2. Mounting: Roller assembly mounted.
3. Motor Voltage: 24 VDC.
4. Descent Speed: 6 inches per second (152 mm per second), minimum; 24 inches per second (609 mm per second), maximum.

2.04 MATERIALS

A. Galvanized Steel Sheet: ASTM A653/A653M, galvanized to minimum G90/Z275 (G90/Z275) coating.

PART 3 EXECUTION

3.01 INSTALLERS

3.02 EXAMINATION

A. Verify areas of installation and conditions, with installer present, for compliance with requirements for supporting members, blocking, installation tolerances, clearances, and other conditions for proper installation of this work.

B. Verify for proper installation of inserts, clips, blocking, or other components being installed by others to hood and control panel.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 INSTALLATION

A. Install system in accordance with manufacturer's written installation instructions.

B. Install anchorage devices to securely fasten hood assembly to substrate and building framing without distortion or stress.

C. Securely and rigidly brace components suspended from structure.

D. Fit and align assembly including vertical guides; level and plumb, to provide smooth operation.

E. Install conduit and wiring from disconnect to unit components; coordinate installation of electrical service with Section 26 0533.13 and Section 26 0583 requirements.

F. Coordinate fire suppression sprinkler system connection in compliance with requirements of Section 21 1300.

G. Coordinate fire alarm system and smoke detector connection in compliance with requirements of Section 28 4600.

H. Coordinate installation of smoke and relief vents as required for draft curtain system in compliance with requirements of Section 07 7200

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Provide services of manufacturer's field representative to observe installation, conduct field testing and inspection, and submit report.

C. Provide testing and inspection for the following:

1. Verify deployment of protective curtain upon signal from fire alarm system and smoke detectors.

2. Verify protective curtain deploys properly by gravity upon damage to control panel or loss of power; possibly caused by emergency situation.

D. Replace protective curtain components that have failed field testing and retest until performance is satisfactory.

3.05 CLEANING

A. Remove labels and visible markings from protective curtain components.

3.06 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

3.07 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide a separate maintenance contract for periodic inspection and performance analysis of smoke and fire protective curtain assemblies in compliance with NFPA 3 and NFPA 4 for one year from Date of Substantial Completion.

END OF SECTION

SECTION 07 9200
JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Self-leveling pourable joint sealants.

C. Joint backings and accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: Additional requirements for sealants and primers.

B. Section 07 1300 - Sheet Waterproofing: Sealing cracks and joints in waterproofing substrate surfaces using materials specified in this section.

C. Section 07 2500 - Weather Barriers: Sealants required in conjunction with air barriers and vapor retarders.

D. Section 07 8400 - Firestopping: Firestopping sealants.

E. Section 07 9100 - Preformed Joint Seals: Precompressed foam, gaskets, and strip seals.

F. Section 07 9513 - Expansion Joint Cover Assemblies: Sealants forming part of expansion joint cover assemblies.

G. Section 08 7100 - Door Hardware: Setting exterior door thresholds in sealant.

H. Section 08 8000 - Glazing: Glazing sealants and accessories.

I. Section 09 2116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.

J. Section 09 2216 - Non-Structural Metal Framing: Sealing between framing and adjacent construction in acoustical and sound-rated walls and ceilings.

K. Section 09 2300 - Gypsum Plastering: Sealing acoustical and sound-rated walls and ceilings.

L. Section 09 2613 - Gypsum Veneer Plastering: Sealing acoustical and sound-rated walls and ceilings.

M. Section 09 3000 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

N. Section 23 3100 - HVAC Ducts and Casings: Duct sealants.

1.03 REFERENCE STANDARDS

A. ASTM C794 - Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants 2018.

B. ASTM C834 - Standard Specification for Latex Sealants 2017.

C. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications 2012 (Reapproved 2017).

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.

E. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems 2016.

F. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.

G. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants 2008 (Reapproved 2012).

1.04 SUBMITTALS

A. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
   1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
   4. Substrates the product should not be used on.

B. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.

D. Installation Plan: Submit at least four weeks prior to start of installation.

E. Installation Log: Submit filled out log for each length or instance of sealant installed.

F. Field Quality Control Log: Submit filled out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.

G. Joint-Sealant Schedule: Include the following information:
   1. Joint-sealant application, joint location, and designation.
   2. Joint-sealant manufacturer and product name.
   3. Joint-sealant formulation.
   4. Joint-sealant color.

1.05 QUALITY ASSURANCE

A. Maintain one copy of each referenced document covering installation requirements on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

D. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section. Agency must bey qualified according to ASTM C 1021 to conduct testing indicated.

E. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
   1. Adhesion Testing: In accordance with ASTM C794.
   2. Compatibility Testing: In accordance with ASTM C1087.
   3. Stain Testing: In accordance with ASTM C1248; required only for stone substrates.
   4. Allow sufficient time for testing to avoid delaying the work.
   5. Deliver to manufacturer sufficient samples for testing.
   6. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.

7. Testing is not required if sealant manufacturer provides data showing previous testing, not older than 24 months, that shows satisfactory adhesion, lack of staining, and compatibility.

F. Installation Plan: Include schedule of sealed joints, including the following.

1. Joint width indicated in contract documents.

G. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.06 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.07 WARRANTY

A. Correct defective work within a five year period after Date of Substantial Completion.

B. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal , exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 JOINT SEALANT APPLICATIONS

A. Scope:

1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
    a. Wall expansion and control joints.
    b. Joints between door, window, and other frames and adjacent construction.
    c. Joints between different exposed materials.
    d. Openings below ledge angles in masonry.
    e. Other joints indicated below.
2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
    a. Joints between door, window, and other frames and adjacent construction.
    b. Other joints indicated below.
3. Do not seal the following types of joints.
    a. Intentional weepholes in masonry.
    b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.

c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.

d. Joints where installation of sealant is specified in another section.

e. Joints between suspended panel ceilings/grid and walls.

B. Butyl Joint Sealants:

1. Comply with ASTM C 1311.

2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Bostik, Inc.

b. Pecora Corporation.

2.02 JOINT SEALANTS - GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.03 NONSAG JOINT SEALANTS

A. Type Silicone, S, NS 50, NT - Silicone Sealant: ASTM C920, Uses S and T; single-component, explicitly approved by manufacturer for traffic exposure when recessed below traffic surface; not expected to withstand continuous water immersion.

1. Manufacturers:

a. Dow Corning Corporation

b. GE Construction Sealants

c. Momentive Performance Materials, Inc.

d. May National Associates, Inc., a subsidiary of Sika Corporation

e. Pecora Corporation

f. Sika Corporation

B. Type Silicone, Acid Curing, S, NS, 25, NT - Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.

1. Manufacturers:

a. Dow Corning Corporation.

b. GE Construction Sealants;

c. Momentive Performance Materials Inc.

d. May National Associates, Inc., a subsidiary of Sika Corporation.

e. Sika Corporation

f. Soudal USA

g. Tremco Incorporated

C. Type OP, Grade NF - Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.

1. Manufacturers:
    a. BASF Construction Chemicals - Building Systems.
    b. May National Associates, Inc.; a subsidiary of Sika Corporation.
    c. Pecora Corporation.
    d. Sherwin-Williams Company (The).
    e. Tremco Incorporated.

2.04 SELF-LEVELING SEALANTS

2.05 ACCESSORIES

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Remove laitance and form-release agents from concrete.
3. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
    a. Metal
    b. Glass
4. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint- sealant bond; do not allow spillage or migration onto adjoining surfaces.
5. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling

without disturbing joint seal.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Perform acoustical sealant application work in accordance with ASTM C919.

D. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

F. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.04 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:
    a. Perform 1 tests for the first 10 of joint length for each kind of sealant and joint substrate.
2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
    a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
3. Inspect tested joints and report on the following:
    a. Whether sealants filled joint cavities and are free of voids.

b. Whether sealant dimensions and configurations comply with specified requirements.

c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.

5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.05 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.06 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.07 JOINT SEALANT SCHEDULE

A. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Control and expansion joints on exposed interior surfaces of exterior walls.

b. Tile control and expansion joints.

c. Vertical joints on exposed surfaces of walls and partitions.

d. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone joint sealant

3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.

1. Joint Locations:

a. Control joints on exposed interior surfaces of exterior walls.

b. Perimeter joints between interior wall surfaces and frames of interior doors and windows.

c. Other joints as indicated on Drawings.

d. Joint Sealant: Silicone joint sealant

e. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces

1. Joint Locations:

a. Joints between plumbing fixtures and adjoining walls, floors, and counters.

b. Tile control and expansion joints where indicated.

c. Joints between countertop and walls and floors

d. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT. 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Concealed mastics.

1. Joint Locations:

a. Aluminum thresholds.

b. Sill plates.

c. Other joints as indicated on Drawings.

d. Joint Sealant: Butyl-rubber based.

3.08 POST-OCCUPANCY

A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width; i.e. at low temperature in thermal cycle. Report failures immediately and repair.

END OF SECTION

SECTION 08 0671
DOOR HARDWARE SCHEDULE

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware: Requirements to comply with in coordination with this section.

1.02 REFERENCE STANDARDS

A. BHMA (CPD) - Certified Products Directory 2017.

B. BHMA A156.3 - American National Standard for Exit Devices 2014.

C. BHMA A156.5 - American National Standard for Cylinders and Input Devices for Locks 2014.

D. BHMA A156.13 - American National Standard for Mortise Locks & Latches Series 1000 2017.

E. BHMA A156.18 - American National Standard for Materials and Finishes 2016.

F. DHI (H&S) - Sequence and Format for the Hardware Schedule 1996.

1.03 PROJECT INFORMATION

A. Architect: Department of Capital Programming at Prince Georges County Public Schools.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Only manufacturers listed in Door Hardware Schedule or Section 08 7100 are considered acceptable, unless noted otherwise.

B. Obtain each type of door hardware as indicated from a single manufacturer and single supplier.

C. Manufacturer's Abbreviations: Coordinate with manufacturers listed in Section 08 7100.

2.02 DESCRIPTION

A. Door hardware sets provided represent the design intent, they are only a guideline and should not be considered a detailed or complete hardware schedule.

1. Provide door hardware item(s) as required for similar purposes, even when item is not listed for a door in Door Hardware Schedule.

2. Necessary items that are not included in a Hardware Set should be added and have the appropriate additional hardware as required for proper application and functionality.

3. Door hardware supplier is responsible for providing proper size and hand of door for products required in accordance with Door Hardware Schedule and as indicated on drawings.

4. Quantities listed are for each Pair (PR) of doors, or for each Single (SGL) door, as indicated in hardware sets.

2.03 LOCK FUNCTION CODES

A. Function Codes for Cylindrical Locks: Complying with BHMA A156.5.

1. Code F76; Privacy Lock: Outside knob/lever locked by pushbutton on inside knob/lever. Rotating inside knob/lever or closing door releases/unlocks button. Emergency release in outside knob/lever.

2. Code F84; Classroom Lock: Outside knob/lever locked/unlocked by key in outside knob/lever. Inside knob/lever always free. Deadlocking latchbolt.

3. Code F85: Classroom Lock with Hold Back Feature: Deadlocking latch bolt by knobs. Outside knob is locked by key in outside knob. Inside knob is always free. Latch may be held back by depressing

latch and rotating key.

4. Code F88; Entry/Restroom Lock: Deadlocking latch bolt by levers except when outside lever is locked by key inside, then by key outside.
5. Code F109; Entry/Office Lock: Turn/Push button locking. Pushing and turning button on inside locks outside knob/lever requiring use of a key until button is manually unlocked. Push button locking. Pushing button locks the outside knob/lever until unlocked by key or by turning the inside knob/lever. Inside knob/lever always free.

B. Function Codes for Mortise Locks: Complying with BHMA A156.13.

1. Code F01; Passage/Closet Latchset: Latch bolt by knobs at all times.
    a. Connecting Room/Exit Latch: Deadlocking latch bolt by inside knob. Non-removable blank plate outside.
2. Code F02; Privacy Lock: Latch bolt by knobs, deadbolt by turn inside or emergency key outside.
3. Code F04: Entry/Office Lock: Deadlocking latch bolt by knobs except when outside knob is locked by buttons in face (edge), then by key outside.
4. Code F05; Classroom Lock: Deadlocking latch bolt by knobs. Outside knob locked by key outside. Inside knob always free.
    a. Schoolhouse Safety Deadlock: Deadbolt retracted by key outside or turn inside. Deadbolt projected by key outside.
5. Code F07; Storeroom/Exit Lock: Deadlocking latch bolt by inside knob or key outside. Outside knob rigid.
    a. Storeroom - Fail Secure: Latch bolt operated by knob from inside except when outer knob is electrically unlocked, then latch bolt from either side. When locked, key in cylinder outside retracts latch bolt. Deadlocking latch.
6. Code F08; Front Door Lock: Latch bolt is operated by knob from either side except when outside knob is made inoperative by a stop or mechanical means other than key. Deadbolt is operated by turn inside. Key outside operates both locks.
7. Code F09; Entry/Restroom Lock: Deadlocking latch bolt by knobs except when outside knob is locked by key inside, then by key outside.
    a. Asylum Lock: Deadlocking latch bolt by key from either side. Both knobs rigid.
8. Codes F10, F12, and F20; Entry/Office Lock: Latch bolt by knobs except when outside knob is made inoperative by buttons in face. Deadbolt by key outside and turn inside. Rotating inside knob retracts both bolts. Deadlocking latch.
9. Code F11; Exit Lock: Latch bolt operated by knob from either side except when outside knob is made inoperative by buttons in lock face. Deadbolt projected by key from either side. Deadbolt retracted by key from outside. Both bolts retracted by inside knob. Deadlocking latch.
10. Code F16; Deadlock: Deadbolt by key from either side.
11. Code F17; Deadlock: Deadbolt by key outside or turn inside.
12. Code F18; Deadlock: Deadbolt by key outside.
13. Code F21; Entry/Office Lock: Latch bolt by knobs. Deadbolt by key outside or turn inside.
    a. Entry: Latch bolt by knob both sides except when deadbolt is projected/retracted by key outside or T-turn inside. When deadbolt is projected both inner and outer knob is rigid. Deadlocking latch.

14. Code F22; Privacy Lock: Latch bolt operated by knob from either side except when outside knob is locked by inside T-turn. Operating inside knob, closing door, or operating outside emergency release unlocks outside knob. Emergency tool finished with lock.
    a. Double Cylinder - Fail Safe: Latch bolt operated by knob from either side except when electrically locked, then both knobs become inoperative. When lock is electrically locked, key in either cylinder retracts latch bolt. Deadlocking latch.
    b. Double Cylinder - Fail Secure: Both knobs inoperative except when electrically unlocked, then latch bolt operated by knob from either side. Latch bolt by key in either cylinder when lock is locked. Deadlocking latch.

C. Function Codes for Exit Devices: Complying with BHMA A156.3.
    1. Code 01; Exit Device: Exit only/no trim.
    2. Code 02; Exit Device: Entrance by pull/trim when actuating bar is locked down (Dogged-Down). Note-Fire Exit devices cannot be locked down.
    3. Code 03; Exit Device: Entrance by trim when latchbolt is retracted by key (pullside). Unit is locked when the key is removed.
    4. Code 04; Exit Device: Entrance by trim when latchbolt is retracted by key (pullside) or set in a retracted position by key.
    5. Code 05; Exit Device: Entrance by thumbpiece. Key (pullside) locks/unlocks thumbpiece.
    6. Code 06; Exit Device: Entrance by thumbpiece only when released by key (pullside). Unit is locked when the key is removed.
    7. Code 07; Exit Device: Entrance by thumbpiece. Inside key (on pushside/on active device case) locks/unlocks thumbpiece. Outside key (pullside) retracts latch.
    8. Code 08; Exit Device: Entrance by knob/lever. Key (pullside) locks/unlocks knob/lever.
    9. Code 09; Exit Device: Entrance by knob/lever with key (pullside) only. Unit is locked when the key is removed.
    10. Code 10; Exit Device: Entrance by knob/lever. Inside key (pushside) locks/unlocks knob/lever. Outside key (pullside) only retracts latch.
    11. Code 11; Exit Device: Entrance by auxiliary control turnpiece. Key (pullside) locks/unlocks auxiliary control.
    12. Code 12 ; Exit Device: Entrance by auxiliary control turnpiece only when released by turning key (pullside). Unit is locked when the key is removed.

2.04 FINISHES

A. Finishes: Complying with BHMA A156.18.
    1. [_____].

PART 3 EXECUTION

3.01 DOOR HARDWARE SCHEDULE

A. Organize listing of door hardware components within each hardware set in compliance with 10-Part scheduling sequence indicated in DHI (H&S), unless otherwise indicated.

3.02 HARDWARE SET # [___]: "[_____]"

A. For use on Door Number(s): [_____].

B. Provide for each Single (SGL) door(s).

UNITS	LOCK	ITEM	DESCRIPTION	FINISH	MFR

3.03 HARDWARE SET # 01: "UNISEX RESTROOM"

A. For use on Door Number(s): 105A, 106A, and 108A.

B. Provide for each Single (SGL) door(s).

UNITS	LOCK	ITEM	DESCRIPTION	FINISH	MFR
4 Each		HINGE	5BB1 4.5 X 4.5	652	IVE
1 Each	F76	PRIVACY LOCK	L9040 17A L583-363	626	SCH
1 Each		WALL STOP	WS407CVX	630	IVE
3 Each		SILENCER	SR64	GRY	IVE

3.04 HARDWARE SET # 02: "CORRIDOR TO RECEPTION ROOMS"

A. For use on Door Number(s): 100A, 104A, and 104B.

B. Provide for each Single (SGL) door(s).

UNITS	LOCK	ITEM	DESCRIPTION	FINISH	MFR
4 Each		HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1 Each	F84	CLASSROOM LOCK	L9070HD 17A	626	SCH
1 Each		PERMANENT CORE	OWNER SUPPLIED	626	BAS
1 Each		SURFACE CLOSER	4111 EDA	689	LCN
1 Each		KICK PLATE	8400 10 Inch X 2 Inch LDW	630	IVE
1 Each		WALL STOP	WS407CVX	630	IVE
3 Each		SILENCER	SR64	GRY	IVE

3.05 HARDWARE SET # 03: "BOARDROOM ENTRY FROM RECEPTION ROOM"

A. For use on Door Number(s): 203A.

B. Provide for each Pair (PR) door(s).

UNITS	LOCK	ITEM	DESCRIPTION	FINISH	MFR
6 Each		HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
2 Each		PUSH PLATE	8200 4 X 16 INCH	630	IVE
2 Each		PULL PLATE	8303-8 3.5 X 15 INCH	630	IVE
2 Each		SURFACE CLOSER	4011	689	LCN
2 Each		KICK PLATE	8400 10 X 2 Inch LDW	630	IVE
2 Each		WALL STOP	WS407CVX	630	IVE
2 Each		SILENCER	SR64	GRY	IVE

3.06 HARDWARE SET # 04: "CLOSET"

A. For use on Door Number(s): 123A.

B. Provide for each Pair (PR) door(s).

UNITS	LOCK	ITEM	DESCRIPTION	FINISH	MFR
6 Each		HINGE	5BB1 4.5 X 4.5	652	IVE

2 Each		ROLLER LATCH	RL32	626	IVE
2 Each		DOOR PULL	SWC1500-04		FOR
1 Each		OH STOP	450S	630	GJ
1 Each		WALL STOP	WS407CVX	630	IVE

3.07 HARDWARE SET # 05: "OFFICE"

A. For use on Door Number(s): 102A, 106A, 110A, and 117A.

B. Provide for each Single (SGL) door(s).

UNITS	LOCK	ITEM	DESCRIPTION	FINISH	MFR
3 Each		HINGE	5BB1 4.5 X 4.5	652	IVE
1 Each	F17	MORTISE LOCK	L9056HD 17A L583-363	626	SCH
1 Each		PERMANENT CORE	OWNER SUPPLIED	626	BAS
1 Each		FLOOR STOP	FS434	604	IVE
3 Each		SILENCER	SR64	GRY	IVE

3.08 HARDWARE SET # 06: "STAIRWAY"

A. For use on Door Number(s): S-1L, and S-2L.

B. Provide for each Single (SGL) door(s).

UNITS	LOCK	ITEM	DESCRIPTION	FINISH	MFR
4 Each		HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1 Set		PUSH PULL	44 SPEC 4' HGTCUSTOM LENGTH BTB ENGRAVED	630	ROC
1 Each		SURFACE CLOSER	4040XP	689	LCN
1 Each		WALL STOP	WS407CVX	630	IVE
3 Each		SILENCER	SR64	GRY	IVE

3.09 HARDWARE SET # 07: "STORE ROOM"

A. For use on Door Number(s): 111A.

B. Provide for each Single (SGL) door(s).

UNITS	LOCK	ITEM	DESCRIPTION	FINISH	MFR
3 Each		HINGE	5BB1 4.5 X 4.5	652	IVE
1 Each	F86	STOREROOM LOCK	L9080HD	626	SCH
1 Each		PERMANENT CORE	OWNER SUPPLIED	626	BAS
1 Each		OH STOP	410S	630	IVE
1 Each		SURFACE CLOSER	4011	689	LCN
1 Each		MOUNTING PLATE	4010-18	689	LCN
1 Each		KICK PLATE	8400 10' X 2' LDW	630	IVE
1 Each		SILENCER	SR64	GRY	IVE

3.10 HARDWARE SET # 08: "RESTROOMS"

A. For use on Door Number(s): 121A, 125A, 212A, and 225A.

B. Provide for each Single (SGL) door(s).

UNITS	LOCK	ITEM	DESCRIPTION	FINISH	MFR
4 Each		HW HINGE	5BB1HW 4.5 X 4.5	652	IVE
1 Each		PUSH PLATE	8200 4 X 16 INCH	630	IVE
1 Each		PULL PLATE	8303-8 3.5 X 15 INCH	630	IVE
1 Each		SURFACE CLOSER	4111 EDA	689	LCN

1 Each		KICK PLATE	8400 10' X 2' LDW	630	IVE
1 Each		WALL STOP	WS33	626	IVE
3 Each		SILENCER	SR64	GRY	IVE

END OF SECTION

SECTION 08 1113
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Hollow metal frames for wood doors.

C. Fire-rated hollow metal doors and frames.

D. Thermally insulated hollow metal doors with frames.

E. Sound-rated hollow metal doors and frames.

F. Bullet-resistant hollow metal doors and frames.

G. Stainless-steel hollow metal doors and frames.

H. Accessories, including glazing, louvers and matching panels.

1.02 RELATED REQUIREMENTS

A. Section 08 1119 - Stainless-Steel Doors and Frames.

B. Section 08 3473 - Sound Control Door Assemblies.

C. Section 08 7100 - Door Hardware.

D. Section 08 8000 - Glazing: Glass for doors and borrowed lites.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

B. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames 2007 (R2011).

C. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors 2011.

D. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames 2003 (R2009).

E. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100) 2017.

F. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames 2011.

G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2017.

H. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable 2018.

I. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.

J. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames 2016.

K. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

L. ITS (DIR) - Directory of Listed Products current edition.

M. NAAMM HMMA 805 - Recommended Selection and Usage Guide for Hollow Metal Doors and Frames 2012.

N. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames 2002.

O. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames 2011.

P. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames 2007.

Q. NAAMM HMMA 850 - Fire-Protection and Smoke Control Rated Hollow Metal Door and Frame Products 2014.

R. NAAMM HMMA 860 - Guide Specifications for Hollow Metal Doors and Frames 2013.

S. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames 2014.

T. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2019.

U. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives 2016.

V. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2017.

W. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames 2013.

X. UL (DIR) - Online Certifications Directory Current Edition.

Y. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.

Z. UL 752 - Standard for Bullet-Resisting Equipment Current Edition, Including All Revisions.

AA. UL 1784 - Standard for Air Leakage Tests of Door Assemblies Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

D. Samples: Submit two samples of metal, showing factory finishes, colors, and surface texture.

E. Design Submittals: Manufacturer to submit anchor design analysis calculations for blast-resistant doors signed and sealed by specialty design engineer experienced in this type of work and licensed in Maryland.

F. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

G. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

H. Manufacturer's Qualification Statement.

I. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

C. Maintain at project site copies of reference standards relating to installation of products specified.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:

1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
2. Curries, an Assa Abloy Group company: www.assaabloydss.com/#sle.
3. Fleming Door Products, an Assa Abloy Group company: www.assaabloydss.com/#sle.
4. Steelcraft, an Allegion brand: www.allegion.com/#sle.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Bullet-Resistant and Detention Security Hollow Metal Doors and Frames:

1. Fleming Door Products, an Assa Abloy Group company: www.assaabloydss.com/#sle.
2. Mesker, dormakaba Group; BR Series Bullet-Resistant Doors and Frames: www.meskeropeningsgroup.com/#sle.
3. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:

1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
2. Accessibility: Comply with ICC A117.1 and ADA Standards.
3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
4. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturers standard.
5. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Hollow Metal Panels: Same construction, performance, and finish as doors.

C. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

A. Door Finish: Factory finished.

B. Exterior Doors: Thermally insulated.

1. Based on NAAMM HMMA Custom Guidelines:
    a. Comply with guidelines of NAAMM HMMA 860 for Hollow Metal Doors and Frames.
    b. Performance Level 1 - Light Duty, in accordance with NAAMM HMMA 805.
    c. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
    d. Door Face Metal Thickness: 20 gage, 0.032 inch (0.8 mm), minimum.
2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
3. Door Thermal Resistance: R-Value of 6.0 minimum, for installed thickness of polystyrene.
4. Door Thickness: as indicated on plans.
5. Weatherstripping: Refer to Section 08 7100.

C. Interior Doors, Non-Fire-Rated:

1. Based on NAAMM HMMA Custom Guidelines:
    a. Comply with guidelines of NAAMM HMMA 860 for Hollow Metal Doors and Frames.
    b. Performance Level 1 - Light Duty, in accordance with NAAMM HMMA 805.
    c. Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
    d. Door Face Metal Thickness: 20 gage, 0.032 inch (0.8 mm), minimum.
2. Door Thickness: 1-3/4 inch (44.5 mm), nominal.

D. Fire-Rated Doors:

1. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
2. Provide units listed and labeled by UL (DIR) or ITS (DIR).
    a. Attach fire rating label to each fire rated unit.
3. Smoke and Draft Control Doors (Indicated with letter "S" on Drawings and/or Door Schedule): Self-closing or automatic closing doors in accordance with NFPA 80 and NFPA 105, with fire-resistance-rated wall construction rated the same or greater than the fire-rated doors, and the following;
    a. Maximum Air Leakage: 3.0 cfm/sq ft (0.02 cu m/sec/sq m) of door opening at 0.10 inch w.g. (24.9 Pa) pressure, when tested in accordance with UL 1784 at both ambient and elevated temperatures.
    b. Gasketing: Provide gasketing or edge sealing as necessary to achieve leakage limit.
    c. Label: Include the "S" label on fire-rating label of door.
4. Door Thickness: 1-3/4 inch (44.5 mm), nominal.

E. Sound Control Door Assemblies: Refer to Section 08 3473.

2.04 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Exterior Door Frames: Full profile/continuously welded type.

1. Weatherstripping: Separate, see Section 08 7100.

C. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.

D. Door Frames, Fire-Rated: Knock-down type.

1. Fire Rating: Same as door, labeled.

E. Sound-Rated Door Frames: Knock-down type.

F. Bullet-Resistant Door Frames: Comply with UL 752, with same level of bullet resistance as door; face welded construction, ground smooth, fully prepared and reinforced for hardware installation.

1. Frame Metal Thickness: 16 gage, 0.053 inch (1.3 mm), minimum.

G. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.

H. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inch (102 mm) high to fill opening without cutting masonry units.

2.05 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

B. Factory Finish: Complying with ANSI/SDI A250.3, manufacturer's standard coating.

2.06 ACCESSORIES

A. Louvers: Roll formed steel with overlapping frame; finish same as door components ; factory-installed.

1. In Fire-Rated Doors: UL (DIR) or ITS (DIR) listed fusible link louver, same rating as door.

B. Glazing: As specified in Section 08 8000, factory installed.

C. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.

D. Astragals for Double Doors: Specified in Section 08 7100.

E. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.

F. Grout for Frames: Portland cement grout with maximum 4 inch (102 mm) slump for hand troweling; thinner pumpable grout is prohibited.

G. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

H. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

I. Drip Caps: Provide for all exterior doors. Secure to top of frame.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Install prefinished frames after painting and wall finishes are complete.

C. Install fire rated units in accordance with NFPA 80.

D. Coordinate frame anchor placement with wall construction.

E. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

F. Install door hardware as specified in Section 08 7100.

1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.

G. Comply with glazing installation requirements of Section 08 8000.

H. Coordinate installation of electrical connections to electrical hardware items.

I. Touch up damaged factory finishes.

3.04 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch (1.6 mm) measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

B. Adjust sound control doors so that seals are fully engaged when door is closed.

C. Test sound control doors for force to close, latch, and unlatch; adjust as necessary in compliance with requirements.

END OF SECTION

SECTION 08 1116
ALUMINUM DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum doors and frames.

B. Weatherstripping.

C. Perimeter sealant.

D. Frame mounted light shelf.

1.02 PERFORMANCE REQUIREMENTS

A. Design and size components to withstand the following load requirements without damage or permanent set, when tested in accordance with ASTM E 330, using loads 1.5 times the design wind loads and 10 second duration of maximum load.

1. Design Wind Loads: Comply with requirements of IBC 2006 - International Building Code.

2. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.

B. Movement: Accommodate movement between perimeter framing and deflection of lintel, without damage to components or deterioration of seals.

C. Air Infiltration: Limit air infiltration through assembly to 0.06 cu ft/min/sq ft of wall area, measured at a reference differential pressure across assembly of 6.24 psf as measured in accordance with ASTM E 283.

D. Condensation Resistance Factor: CRF of not less than 57 (exterior frames) when measured in accordance with AAMA 1503.1.

E. Thermal Resistance of Exterior Framing: Thermal transmittance U value not more than 0.44 BTU/HR/FT²/°F when measured in accordance with AAMA 1503.1.

F. Water Leakage: None, when measured in accordance with ASTM E 331 with a test pressure difference of 12 lbf/sq ft.

G. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

H. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, internal drainage details .

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.

1. Shop drawings must be prepared by the manufacturer under the supervision of a Professional Structural Engineer licensed in the State of Maryland.

2. Shop drawings must be signed and sealed by the supervising Professional Structural Engineer.

D. Design Data: Provide framing member structural and physical characteristics, engineering calculations, dimensional limitations, including the impact of the frame mounted sunshades.

1. Must be signed and sealed by the supervising Professional Structural Engineer.

E. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

F. LEED Report: Accurately document the use of recycled materials and local/regional materials, as required by Section 01 35 14, Section 01 35 15, Section 01 35 16 and appropriate forms, and Section 01 60 00.

G. LEED Submittals: Provide VOC content documentation for field-applied sealants and primers; comply with VOC content limits of Section 01 61 16.

H. Report of field testing for water leakage.

I. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed at the State of Maryland.

B. Manufacturer and Installer Qualifications: Company specializing in manufacturing aluminum glazing systems with minimum five years of documented experience.

1.05 PRE-INSTALLATION MEETING

A. Convene one week before starting work of this section.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.07 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a ten year period after Date of Substantial Completion.

C. Provide ten year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. EFCO, a Pella Company; Product System 403 (T) Wall (exterior) and Product System 402 (interior): www.efcocorp.com.

B. (Basis-of-Design) Kawneer North America; Product TriFab VG 451T (exterior) and TriFab VG 451 (interior): www.kawneer.com.

C. YKK AP America; Product System YES 45 TU (exterior) and Product System YES 45 FI (interior): www.ykkap.com.

2.02 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.

1. Framing members for interior applications need not be thermally broken.
2. Glazing stops: Flush.
3. Structurally Reinforced Members: Extruded aluminum with internal reinforcement of structural steel member.

B. Doors: Glazed aluminum.

1. Thickness: 2 inches.
2. Glazing Stops: Square.

C. Horizontal Sun Shades: Shop fabricated, shop finished, extruded aluminum outriggers, louvers, and fascia, free of defects impairing strength, durability or appearance.

1. Basis-of-Design: Kawneer; SunShade, other approved sunshades are as follows:
   a. YKK; ThermaShade
   b. EFCO; X-Therm E-Shade
2. Configuration: Horizontal.
3. Louver Type: 4" Airfoil.
4. Outrigger Shape: Tapered as indicated on the drawings.
5. Fascia: 3 inch diameter round.
6. Design Criteria: Design and fabricate to resist the same loads as storefront system as well as the following loads without failure, damage, or permanent deflection:
   a. Snow: 30 psf; minimum.
   b. Live: 30 psf; minimum.
   c. Thermal Movement: Plus/minus 1/8 inch, maximum.
7. Size: 2'-8" projection.
8. Shop fabricate to the greatest extent possible; disassemble if necessary for shipping.
9. Finish to match storefront framing system.

2.03

A. Lightshelf: (Basis-of-Design) InLighten, or equal by EFCO or YKK.

1. Aluminum horizontal supporting extrusions shall have a minimum wall thickness of .063” (1.5 mm) to .125" (3 mm).
2. Shelf receiver shall be extrusions with a nominal wall thickness of .125” (3 mm).
3. Struts shall be extrusions with a nominal wall thickness of .094” (2.5 mm).
4. Shading Device:
   a. Horizontal components shall be mechanically fastened by means of aluminum sheets.
5. Finish: Match Storefront System color and finish.

B. Vents: Provide project-out units.

1. The windows shall be Architectural Aluminum Project Out windows in accordance with ANSI/AAMA/nwwda 101/I.S.2-97 or NAFS-1 Voluntary Specifications for Aluminum and Poly Prime Windows and Glass Doors for a Class and Grade of P-HC40 to P-HC70 for Project Out Windows.
    a. Units submitted for laboratory testing shall be manufacturer's standard construction, glazed and assembled in accordance with manufacturer's specifications and ANSI/AAMA/nwwda 101/I.S.2-97 or NAFS-02.
2. Hinge: Concealed stainless steel four- or six-bar friction hinge; two per ventilator.
3. Lock: Manufacturer's cam lock and keeper.
4. Finish to match storefront framing system.
5. Basis-of-Design: Kawneer.
6. Insect Screens: Extruded aluminum frames, 6063-T5 alloy and temper, joined at corners; 18 x 16 mesh aluminum screen cloth; splines shall be extruded vinyl, removable to permit rescreening.
    a. Frame Finish: To match aluminum window.
    b. Screen Finish: Black anodized.

2.04 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Sheet Aluminum: ASTM B209 (ASTM B209M).

C. Structural Steel Sections: ASTM A36/A36M; galvanized in accordance with requirements of ASTM A123/A123M.

D. Fasteners: Stainless steel.

E. Concealed Flashings: 0.018 inch thick stainless steel.

F. Perimeter Sealant: Type ES-1 or ES-4 specified in Section 07 90 05.

G. Glass: As specified in Section 08 80 00.

H. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

2.05 FINISHES

A. Superior Performance Organic Coating System: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride system; custom color to match approved sample.

1. Manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.

2.06 HARDWARE

A. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.

B. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.

2.07 FABRICATION

A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.

C. Construct with shear block system of assembly.

D. Prepare components to receive anchor devices. Fabricate anchors.

E. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.

F. Arrange fasteners and attachments to conceal from view.

G. Reinforce components internally for door hardware .

H. Reinforce framing members for imposed loads.

I. Finishing: Apply factory finish to all surfaces that will be exposed in completed assemblies.

1. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Coordinate attachment and seal of perimeter air and vapor barrier materials.

I. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

J. Install operating sash.

K. Set thresholds in bed of mastic and secure.

L. Install hardware using templates provided.

M. Install glass and infill panels in accordance with Section 08 80 00, using glazing method required to achieve performance criteria.

N. Install perimeter sealant in accordance with Section 07 90 05.

O. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 1/16 inches per 10 ft, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.04 FIELD QUALITY CONTROL

A. Test installed storefront for water leakage in accordance with AAMA 501.2.

1. Test a minimum area of 75 feet by 1 story of aluminum-framed systems designated by Architect, before installation of interior finishes; test area may not show evidence of water penetration.

3.05 ADJUSTING

A. Adjust operating hardware and sash for smooth operation.

3.06 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

C. Remove excess sealant by method acceptable to sealant manufacturer.

3.07 PROTECTION

A. Protect installed products from damage during subsequent construction.

END OF SECTION

SECTION 08 1416
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; flush configuration; fire rated, non-rated, and acoustical.

1.02 RELATED REQUIREMENTS

A. Section 08 80 00 - Glazing.

1.03 REFERENCE STANDARDS

A. ASTM E413 - Classification for Rating Sound Insulation.

B. ASTM E1408 - Standard Test Method for Laboratory Measurement of the Sound Transmission Loss of Door Panels and Door Systems.

C. AWI/AWMAC (QSI) - Architectural Woodwork Quality Standards Illustrated; Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada.

D. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc..

E. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.

F. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc..

G. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Specimen warranty.

D. Test Reports: Show compliance with specified requirements for the following:

1. Sound-retardant doors and frames; sealed panel tests are not acceptable.

E. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, factory machining criteria, factory finishing criteria, identify cutouts for glazing and louvers.

F. Samples: Submit two samples of door veneer, 12 x 12 inch in size illustrating wood grain, stain color, and sheen.

G. LEED Submittals:

1. LEED Report: Accurately document the use of recycled content as required by Section 01 35 14, Section 01 35 15, Section 01 35 16 and appropriate forms and Section 01 60 00.

2. Certificates for Credit MR 7: Chain-of-custody certificates certifying that flush wood doors comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.

3. Include statement indicating costs for each certified wood product.

4. Product Data for Credit EQ 4.4: For adhesives and composite wood products, documentation indicating that product contains no added urea formaldehyde.

H. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

A. Installed Fire Rated Door Assembly: Conform to NFPA 80 for fire rated class as indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging. Inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.07 PROJECT CONDITIONS

A. Coordinate the work with door opening construction, door frame and door hardware installation.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Interior Doors: Provide manufacturer's warranty for the life of the installation.

C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Veneer Faced Doors:

B. Eggers Industries: www.eggersindustries.com.

C. Marshfield DoorSystems, Inc: www.marshfielddoors.com.

D. Algoma Hardwoods, Inc. .

E. Oshkosh Architectural Door Company.

F. VT Industries, Inc.

2.02 DOORS

A. All Doors: See drawings for locations and additional requirements.

1. Quality Level: Custom Grade, in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Section 1300.

    a. Grade A faces.

2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.

3. Faces are bonded to core using a hot press.

4. Provide wood doors made from wood harvested from forests certified by an FSC-accredited certification body.

5. Provide doors assembled with glues containing no added urea-formaldehyde.

6. Recycled Content: Provide particleboard door substrates with minimum 80 percent recycled content; mineral core doors with maximum recycled content feasible.

B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.

1. Provide solid core doors at all locations .

2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C or UBC Standard 7-2-97 ("positive pressure"); UL or WH (ITS) labeled without any visible seals when door

is open.

3. Sound Retardant Doors: Minimum STC of 42 or better, calculated in accordance with ASTM E413, tested in accordance with ASTM E1408.
    a. Provide doors specifically designed for sound transmission control with a high density core and damping.
    b. Refer to hardware specification for required hardware items.
4. Wood veneer facing with factory transparent finish .

2.03 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated above.

B. Fire Rated Doors: Mineral core, Type FD, plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

C. Sound Retardant Doors: Equivalent to Type PC construction with core as required to achieve rating specified; plies and faces as indicated above.

2.04 DOOR FACINGS

A. Wood Veneer Facing for Transparent Finish: White Maple, veneer grade as specified by quality standard, plain sliced, book veneer match, running assembly match; unless otherwise indicated.
    1. Vertical Edges: Any option allowed by quality standard for grade.
    2. Pairs: Pair match each pair; set match pairs within 10 feet of each other when doors are closed.
    3. Room Match: Match door faces within each separate room or area of building. Corridor door faces do not need to match where they are separated by 20 feet or more.

2.05 ACCESSORIES

A. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.

2.06 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with Bonded Stiles and Rails:
    1. Provide solid blocks at lock edge for hardware reinforcement.
    2. Provide solid blocking for other throughbolted hardware.

C. Fit door edge trim to edge of stiles after applying veneer facing.

D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

F. Provide edge clearances in accordance with the quality standard specified.

2.07 FACTORY FINISHING - WOOD VENEER DOORS

A. Factory finish doors in accordance with specified quality standard:
    1. Transparent Finish: Transparent catalyzed polyurethane, Premium quality, TR-6, satin sheen.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.
   1. Install fire-rated doors in accordance with NFPA 80 requirements.
B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
C. Use machine tools to cut or drill for hardware.
D. Coordinate installation of doors with installation of frames and hardware.
E. Coordinate installation of glazing.

3.02 TOLERANCES

A. Conform to specified quality standard for fit and clearance tolerances.
B. Conform to specified quality standard for telegraphing, warp, and squareness.

3.03 ADJUSTING

A. Adjust doors for smooth and balanced door movement.
B. Adjust closers for full closure.

END OF SECTION

SECTION 08 1433
STILE AND RAIL WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wood doors, stile and rail design; fire rated and non-fire rated.

B. Panels of wood, glass and louvers.

1.02 RELATED REQUIREMENTS

A. Section 06 2000 - Finish Carpentry: Wood door frames.

B. Section 08 1113 - Hollow Metal Doors and Frames.

C. Section 08 7100 - Door Hardware.

D. Section 08 8000 - Glazing.

1.03 REFERENCE STANDARDS

A. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights 2007 (Reapproved 2016).

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards 2014, with Errata (2016).

C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1 2016, with Errata (2017).

D. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2019.

E. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives 2016.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate stile and rail core materials and construction; veneer species, type and characteristics.

C. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required , special beveling , special blocking for hardware , factory machining criteria , factory finishing criteria , identify cutouts for glazing and louvers.

D. Samples: Submit two samples of door construction cut from top corner of door.

E. Samples: Submit two samples of door veneer illustrating wood grain, stain color, and sheen.

F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

G. Manufacturer's Installation Instructions: Indicate special installation instructions.

H. Manufacturer's Qualification Statement.

I. Installer's Qualification Statement.

J. Warranty, executed in Owner 's name.

1.05 QUALITY ASSURANCE

A. Maintain one copy of specified door quality standard on site for review during installation and finishing.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.

1. Company with at least one project within the past 5 years with value of woodwork within 20 percent of cost of woodwork for this project.
2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.

C. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

D. Quality Certification:

1. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
2. Provide designated labels on shop drawings as required by certification program.
3. Provide designated labels on installed products as required by certification program.
4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver, and store doors in accordance with quality standard specified.

B. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials and telegraphing core construction.

PART 2 PRODUCTS

2.01 DOORS

A. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless otherwise indicated.

B. Exterior Doors: 1-3/4 inches (44.45 mm) thick unless otherwise indicated; solid lumber construction; mortise and tenon joints; water repellent treated. Transparent finish as indicated on drawings.

2.02 DOOR AND PANEL FACINGS

A. Veneer Facing for Transparent Finish: Species as specified above, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.

B. Adhesive: Type I - Waterproof.

2.03 DOOR CONSTRUCTION

A. Vertical Exposed Edge of Stiles: Of same species as veneer facing.

B. Fit door edge trim to edge of stiles after applying veneer facing.

C. Panels: Raised, solid wood.

D. At exterior doors, provide aluminum flashing at the top and bottom rail for full thickness and width of door.

E. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.

2.04 FACTORY FINISHING

A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:

1. Transparent:

a. Stain: As selected by Architect.

2.05 ACCESSORIES

A. Glazing: As specified in Section 08 8000.

B. Panel or Glass Retention Molding: Wood of same species as door facing with butted corners; prepared for countersink style screws.

C. Door Hardware: As specified in Section 08 7100.

D. Wood Louvers: Wood, of same species as door facing.

E. Metal Louvers: As specified in Section 08 1113.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out of tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standards.

1. Install fire-rated doors in accordance with NFPA 80 requirements.

2. Install smoke and draft control doors in accordance with NFPA 105 requirements.

3. Install exterior doors in accordance with ASTM E2112.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Field-Finished Doors: Trimming to fit is acceptable.

D. Machine cut for hardware.

E. Coordinate installation of doors with installation of frames and hardware.

F. Coordinate installation of glazing.

3.03 TOLERANCES

A. Comply with specified quality standard for fit, clearance, and joinery tolerances.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

END OF SECTION

SECTION 08 3100
ACCESS DOORS AND PANELS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Access door and frame units, fire-rated, in wall locations.

1.02 REFERENCE STANDARDS

A. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc..

B. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc..

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

C. Shop Drawings: Indicate exact position of all access door units.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Babcock-Davis / Nystrom.

1. Non-Rated: B-NT / NT Series.
2. Rated: B-IT / IT Series.

B. Karp Associates, Inc: www.karpinc.com.

C. Milcor by Commercial Products Group of Hart & Cooley, Inc: www.milcorinc.com.

D. L. Industries, Inc. .

E. Larsen's Manufacturing Company.

F. Williams Bros. Corporation of America (The).

2.02 ACCESS DOORS AND PANELS

A. All Units: Factory fabricated, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assemblies units are to be installed in.

B. Units in Fire Rated Assemblies: Fire rating equivalent to the fire rated assembly in which they are to be installed.

1. Provide products listed and labeled by UL or ITS (Warnock Hersey) as suitable for the purpose specified and indicated.

2.03 ACCESS DOOR UNITS - WALLS AND CEILINGS

A. Door and Frame Units: Formed steel.

1. Door: Minimum 16 gage thick sheet metal, set flush with exposed face flange of frame.
2. Frame: Minimum 16 gage thick sheet metal with 1 inch wide, surface-mounted trim.
3. Hinges: Concealed pivot rod.
4. Lock: Provide door panel with cylinder keyed to building masterkey program.

B. Fire-Rated, Insulated, Flush Access Doors and Frames with Exposed Trim: Formed steel.

1. Fire-Resistance Rating: Not less than that of adjacent construction.
2. Temperature Rise Rating: 250 deg F at the end of 30 minutes.
3. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 20 gage.
4. Frame: Minimum 16 gage thick sheet metal with 1-inch wide, surface-mounted trim.
5. Hinges: Concealed-pin type.
6. Automatic Closer: Spring type.
7. Lock: Self-latching device with cylinder lock.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings. Secure rigidly in place.

C. Position units to provide convenient access to the concealed work requiring access.

END OF SECTION

SECTION 08 3313
COILING COUNTER DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated coiling counter doors and operating hardware.

B. Fire-rated coiling counter doors and operating hardware.

C. Electric motor operation; wiring from electric circuit disconnect to operator to control station.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Rough openings.

B. Section 08 7100 - Door Hardware: Cylinder cores and keys.

C. Section 26 0583 - Wiring Connections: Power to disconnect.

D. Section 28 4600 - Fire Detection and Alarm: Fire alarm interconnection.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2017.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2014.

C. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2019.

D. UL (DIR) - Online Certifications Directory Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's standard literature showing materials and details of construction and finish. Include data on electrical operation.

C. Shop Drawings: Indicate rough and actual opening dimensions, anchorage methods, hardware locations, and installation details.

D. Samples: Submit two slats, 4 inch long (102 mm long), illustrating shape, color and finish texture.

1.05 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Coiling Counter Doors:

1. Substitutions: See Section 01 6000 - Product Requirements.

B. Coiling Counter Fire Doors:

2.02 COILING COUNTER DOORS

A. Coiling Counter Doors, Non-Fire-Rated: Aluminum slat curtain.

1. Mounting: Between jambs, within prepared opening.

2. Nominal Slat Size: 1-1/4 inches (32 mm) wide.

3. Slat Profile: Flat, perforated.
4. Finish, Aluminum: Anodized.
5. Guides: Formed track; same material and finish unless otherwise indicated.
6. Locking Devices: Lock and latch handle on outside.

B. Coiling Counter Doors, Fire-Rated: Galvanized steel slat curtain.

1. Mounting: Between jambs, within prepared opening.
2. Fire Rating: 3/4 hour; comply with NFPA 80.
3. Nominal Slat Size: 1-1/4 inches (32 mm) wide.
4. Slat Profile: Flat.
5. Guides: Formed track; same material and finish unless otherwise indicated.

2.03 MATERIALS

A. Curtain Construction: Interlocking, single thickness slats.

1. Slat Ends: Alternate slats fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
2. Curtain Bottom: Fitted with angles to provide reinforcement and positive contact in closed position.
3. Steel Slats: ASTM A653/A653M galvanized steel sheet, with minimum G90/Z275 coating; minimum thickness 16 gage, 0.06 inch (1.5 mm).
4. Aluminum Slats: ASTM B221 (ASTM B221M), aluminum alloy Type 6063; minimum thickness 0.05 inch (1.3 mm).

B. Guide Construction: Continuous, of profile to retain door in place, with mounting brackets of same metal.

1. Aluminum Guides: Extruded aluminum channel, with wool pile runners along inside.

C. Lock Hardware:

1. Cylindrical Locking Mechanism: Latchset lock cylinder, specified in Section 08 7100.
2. Latching Mechanism: Inside mounted, adjustable keeper, spring activated latch bar feature to keep in locked or retracted position.

D. Roller Shaft Counterbalance: Steel pipe and torsion steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb (10 kg) nominal force to operate.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that opening sizes, tolerances and conditions are acceptable.

3.02 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install fire-rated doors in accordance with NFPA 80.

C. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

D. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

E. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

F. Coordinate installation of electrical service with Section 26 0583.

G. Install perimeter trim as indicated.

3.03 TOLERANCES

A. Maintain dimensional tolerances and alignment with adjacent work.

B. Maximum Variation From Plumb: 1/16 inch (1.5 mm).

C. Maximum Variation From Level: 1/16 inch (1.5 mm).

D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 ft (3 mm per 3 m) straight edge.

3.04 ADJUSTING

A. Adjust operating assemblies for smooth and noiseless operation.

3.05 CLEANING

A. Clean installed components.

B. Remove labels and visible markings.

END OF SECTION

SECTION 08 3323
OVERHEAD COILING DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Overhead coiling doors , operating hardware, exterior, electric operation.

B. Wiring from electric circuit disconnect to operator to control station.

1.02 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association.

C. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC; National Electrical Manufacturers Association.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide general construction, component connections and details, electrical equipment .

C. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.

D. Samples: Submit two slats, length of 24 inch in size illustrating shape, color and finish texture.

E. LEED Report: Accurately document the use of recycled materials, as required by Section 01 35 14, Section 01 35 15, Section 01 35 16 and appropriate forms, and Section 01 60 00.

F. Maintenance Data: Indicate lubrication requirements and frequency and periodic adjustments required.

1.04 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.05 WARRANTY

A. Warranty Period: Two years for defects in material and workmanship.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Cornell Iron Works, Inc: www.cornelliron.com.

B. The Cookson Company: www.cooksondoor.com.

C. Overhead Door Company .

2.02 COILING DOORS

A. Exterior Coiling Doors: Steel slat curtain.

1. Capable of withstanding positive and negative wind loads of 20 psf, without undue deflection or damage to components.

2. Sandwich slat construction with insulated core of closed cell pressure foamed in place urethane type insulation; insulation (u-) value: 0.50 BTU/hr sq ft deg F

3. Nominal Slat Size: 2 inches wide x required length.

4. Finish: primed steel with powder coated finish..
5. Guides: Angles; galvanized steel.
6. Hood Enclosure: Manufacturer's standard; primed steel with powder coated finish.
7. Electric operation.
8. Mounting: Surface mounted.

2.03 MATERIALS

A. Curtain Construction: Interlocking slats.
   1. Slat Ends: Alternate slats fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
   2. Curtain Bottom: Fitted with angles to provide reinforcement and positive contact in closed position.
   3. Weatherstripping: Moisture and rot proof, resilient type, located at jamb edges and where curtain enters hood enclosure of exterior doors.

B. Steel Slats: Minimum exterior skin of 20 gage/interior skin of 24 gage ASTM A653/A653M galvanized steel sheet.
   1. Galvanizing: Minimum G90/Z275 coating.

C. Steel Guides: Minimum 3/16 inch angle assemblies bolted to wall; powder coat finish.

D. Roller Shaft Counterbalance: Steel pipe and helical steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb nominal force to operate.

2.04 ELECTRIC OPERATION

A. Electric Operators:
   1. Mounting: Side mounted.
   2. Motor Rating: 1/2 hp; continuous duty.
   3. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
   4. Controller Enclosure: NEMA 250 Type 1.
   5. Opening Speed: 12 inches per second.
   6. Brake: Adjustable friction clutch type, activated by motor controller.
   7. Manual override in case of power failure.

B. Control Station: Standard three button (OPEN-STOP-CLOSE) momentary control for each operator.
   1. 24 volt circuit.
   2. Surface mounted.
   3. Provide key switch control station on exterior; location to be determined.

C. Safety Edge: Located at bottom of curtain, full width, electro-mechanical sensitized type, wired to stop operator upon striking object, hollow neoprene covered.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

E. Coordinate installation of electrical service with Section 26 27 17.

F. Complete wiring from disconnect to unit components.

G. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07 90 05.

3.02 TOLERANCES

A. Maintain dimensional tolerances and alignment with adjacent work.

B. Maximum Variation From Plumb: 1/16 inch.

C. Maximum Variation From Level: 1/16 inch.

D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 ft straight edge.

3.03 ADJUSTING

A. Adjust operating assemblies for smooth and noiseless operation.

3.04 CLEANING

A. Clean installed components.

B. Remove labels and visible markings.

END OF SECTION

SECTION 08 3326
OVERHEAD COILING GRILLES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Overhead coiling metal grilles and operating hardware, electric operation.

B. Wiring from electric circuit disconnect to operator to control station.

1.02 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric].

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association.

D. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC; National Electrical Manufacturers Association.

E. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide general construction, component connections and details, electrical equipment .

C. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.

D. LEED Report: Accurately document the use of recycled materials, as required by Section 01 35 14, Section 01 35 15, Section 01 35 16 and appropriate forms, and Section 01 60 00.

E. Maintenance Data: Indicate lubrication requirements and frequency.

1.04 WARRANTY

A. Warranty Period: Two years for defects in material and workmanship.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Overhead Coiling Grilles:

1. Cornell Iron Works, Inc: www.cornelliron.com.
2. The Cookson Company: www.cooksondoor.com.
3. Wayne-Dalton, a Division of Overhead Door Corporation: www.waynedalton.com.
4. Overhead Door Company: www.overheaddoor.com .

2.02 GRILLE AND COMPONENTS

A. Grille: Aluminum; horizontal bar curtain, coiling on overhead counterbalanced shaft.

1. Finish: Clear anodized.
2. Electric operation.
3. Mounting: Within framed opening.

B. Curtain: Round horizontal bars connected with vertical links.
   1. Horizontal bars: 5/16 inch diameter.
   2. Bar spacing: 1 1/2 inch on center.
   3. Vertical Chains: Eyeletted links standard of manufacturer.
   4. Link spacing: 6 inch on center.
   5. Bottom Bar: Extruded aluminum tubular section.

C. Guides: Extruded aluminum angles, of profile to retain grille in place with snap-on trim, mounting brackets of same metal.

D. Roller Shaft Counterbalance: Steel pipe and helical steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb nominal force to operate.

2.03 MATERIALS

A. Aluminum: ASTM B221 (ASTM B221M).

2.04 ELECTRIC OPERATION

A. Electric Operators:
   1. Mounting: Side mounted.
   2. Motor Enclosure:
      a. Interior grilles: NEMA MG 1 Type 1; open drip proof.
   3. Motor Rating: 1/2 hp; continuous duty.
   4. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
   5. Controller Enclosure: NEMA 250 Type 1.
   6. Brake: Adjustable friction clutch type, activated by motor controller.
   7. Manual override in case of power failure.

B. Control Station: Standard three button (OPEN-STOP-CLOSE) momentary control for each operator.
   1. 24 volt circuit.
   2. Surface mounted.

C. Safety Edge: Located at bottom of curtain, full width, electro-mechanical sensitized type, wired to stop operator upon striking object, hollow neoprene covered.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install grille unit assembly in accordance with manufacturer's instructions.

B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

C. Securely and rigidly brace components suspended from structure.

D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

E. Complete wiring from disconnect to unit components.

3.02 ADJUSTING

A. Adjust grille, hardware and operating assemblies for smooth and noiseless operation.

3.03 CLEANING

A. Clean grille and components.

B. Remove labels and visible markings.

END OF SECTION

SECTION 08 3473
SOUND CONTROL DOOR ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sound control door assemblies.

1. Metal doors and frames.
2. Wood doors and metal frames.
3. Fire-rated doors and frames.
4. Interior doors and frames, non-fire-rated.
5. Thermally insulated exterior door and frames.

B. Accessories, including glazing and matching panels.

1.02 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware.

B. Section 08 8000 - Glazing: Glass for doors and borrowed lites.

C. Section 09 9113 - Exterior Painting: Field painting.

D. Section 09 9123 - Interior Painting: Field painting.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

B. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames 2007 (R2011).

C. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors 2011.

D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100) 2017.

E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames 2011.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2017.

G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable 2018.

H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.

I. ASTM E336 - Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings 2017.

J. ASTM E413 - Classification for Rating Sound Insulation 2016.

K. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards 2014, with Errata (2016).

L. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1 2016, with Errata (2017).

M. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames 2016.

N. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

O. ITS (DIR) - Directory of Listed Products current edition.

P. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames 2002.

Q. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames 2011.

R. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames 2007.

S. NAAMM HMMA 865 - Guide Specifications for Sound Control Hollow Metal Doors and Frames 2013.

T. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2019.

U. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2017.

V. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames 2013.

W. UL (DIR) - Online Certifications Directory Current Edition.

X. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.

Y. UL 1784 - Standard for Air Leakage Tests of Door Assemblies Current Edition, Including All Revisions.

Z. WDMA I.S. 1A - Interior Architectural Wood Flush Doors 2013.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

D. Samples: Submit two samples of metal, 2 inch by 2 inch in size (50 mm by 50 mm in size) showing factory finishes, colors, and surface texture.

E. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

F. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

G. Manufacturer's Qualification Statement.

H. Installer's Qualification Statement.

I. Testing Agency's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

C. Testing Agency Qualifications: Independent testing agency accredited as an acoustical laboratory and certified to perform specified field testing.

D. Maintain at project site copies of reference standards relating to installation of products specified.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect metal doors in compliance with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) and specified requirements.

B. Protect wood doors in compliance with WDMA I.S. 1A and specified requirements.

C. Store wood doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas, or in areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

D. Remove doors and frames from resilient packaging upon delivery on site and inspect for damage, provide cover over doors for protection until installed, and store in vertical position properly braced with blocking to permit air circulation between components.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Accessibility: Comply with ICC A117.1 and ADA Standards.

B. Opening Force of Sound Control Doors, Non-Fire Rated: 5 lbs (22.2 N), maximum, in compliance with ADA Standards.

C. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

D. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with specified requirements for each type; for instance, a sound control door is also indicated as being an exterior door must comply with requirements specified for sound control doors and exterior doors; where two requirements conflict, comply with most stringent.

2.02 COMPONENTS

A. Panels: Same construction, performance, and finish as doors.

B. Exterior Metal Door Top Closures: Flush end closure channel, with top and door faces aligned.

C. Door Edge Profile: Manufacturer's standard for application indicated.

2.03 SOUND CONTROL DOORS

A. Metal Sound Control Interior Doors:

1. Metal Doors: Refer to drawings for locations and additional requirements.
    a. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
        1) Level 1 - Standard-duty.
        2) Physical Performance Level C, 250,000 cycles; in accordance with ANSI/SDI A250.4.
        3) Model 1 - Full Flush.
        4) Door Face Metal Thickness: 20 gage, 0.032 inch (0.8 mm), minimum.
    b. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
        1) Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip

process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.

(a) Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) where necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.

2. Door Thickness: As required to comply with sound control requirements as indicated.
3. Sound Seals: As required by manufacturer to meet indicated sound control ratings.
4. Exterior Doors, Thermally Insulated:
    a. Door Core Material: Manufacturers standard core material and construction to comply with sound control requirements as indicated.

B. Wood Sound Control Interior Doors: Provide fire-rated door construction as indicated.
1. Wood Doors: Refer to drawings for locations and additional requirements.
    a. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless otherwise indicated.
2. Sound Seals: As required by manufacturer to meet indicated sound control ratings.
3. Fire-Rated Doors:
    a. Fire Rating: As indicated on Door Schedule, complying with NFPA 80 and tested in accordance with UL 10C and NFPA 252 as positive pressure fire tests.
    b. Temperature-Rise Rating (TRR) Across Door Thickness: Comply with requirements of local building code and authorities having jurisdiction (AHJ).
    c. Provide units listed and labeled by UL (DIR) or ITS (DIR).
        1) Attach fire rating label to each fire rated unit.
    d. Smoke and Draft Control Doors (Indicated as "S" on Drawings): In addition to required fire rating, provide sound control door assemblies tested in accordance with UL 1784 and maximum air leakage of 3.0 cfm per sq ft (0.01524 cu m/s/sq m) of door opening at 0.10 inch wg (24.9 Pa) pressure at both ambient and elevated temperatures for 'S' label.
    e. Door Core Material: As required by manufacturer to meet indicated fire and sound control ratings.

2.04 SOUND CONTROL DOOR FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Metal Sound Control Interior Door Frames: Face welded type.
1. Frame Finish: Factory finished.
2. Interior Door Frames, Non-Fire Rated:
    a. Terminated Stops: Provide at interior doors; closed end stop terminated 6 inch (150 mm), maximum, above floor at 45 degree angle.
3. Fire-Rated Door Frames:
    a. Fire Rating: Same as door, and labeled.
    b. Terminated Stops: Provide at interior doors; closed end stop terminated 6 inch (150 mm), maximum, above floor at 45 degree angle.

2.05 DOOR HARDWARE

A. Astragals for Double Doors: Overlapping or meeting stile for field installation in compliance with sound control requirements.

1. Fire-Rated Doors: Steel, and shape as required for fire rating.

B. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, two on head of pairs without center mullions, and in compliance with sound control requirements.

C. Hinges: Cam lift type by door manufacturer, coordinate with Section 08 7100.

D. Threshold: Provide sound control/acoustic seal for sill of door in closed position by door manufacturer.

E. Sound Control Seals: Provide sound control/acoustic seals for jambs and head of door in closed position by door manufacturer.

2.06 FINISHES

A. Primer, Metal Doors and Frames: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard, in compliance with local VOC requirements.

B. Metal Door and Frame Finish: Complying with ANSI/SDI A250.3, manufacturer's standard coating.

C. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

2.07 ACCESSORIES

A. Glazing: As specified in Section 08 8000, factory installed, and tested to comply with specified sound control and fire ratings as indicated.

B. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.

C. Grout for Frames: Portland cement grout with maximum of 4 inch (102 mm) slump for hand troweling; thinner pumpable grout of higher slump is not permitted.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

D. Beginning of installation means acceptance of existing conditions.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Install prefinished frames after painting and wall finishes are complete.

C. Install fire rated units in accordance with NFPA 80.

D. Coordinate frame anchor placement with wall construction.

E. Touch up damaged factory finishes.

3.04 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 865.

B. Maximum Diagonal Distortion: 1/16 inch (1.6 mm) measured with straight edge, corner to corner.

3.05 FIELD QUALITY CONTROL

A. Refer to Section 01 4000 - Quality Requirements, for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.

B. Provide field testing of installed sound control doors by independent laboratory in accordance with ASTM E336 test methods, with results calculated in accordance with ASTM E413 and having acceptable field noise isolation class (NIC) values within 5 dB of laboratory STC rating values.

1. Testing agency to submit testing report to Contractor and Architect within 24 hours after field testing has been completed.

C. Repair or replace sound control door components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.06 ADJUSTING

A. Adjust for smooth and balanced sound control door movement.

B. Adjust sound control doors so that seals are fully engaged when door is closed.

C. Adjust sound control doors for force to close, latch, and unlatch; adjust as necessary in compliance with requirements.

3.07 SCHEDULE

A. Refer to Door and Frame Schedule on drawings.

END OF SECTION

SECTION 08 3613
SECTIONAL DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Overhead sectional door electrically operated.

B. Operating hardware and supports.

C. Electrical controls.

1.02 RELATED REQUIREMENTS

A. Section 05 5000 - Metal Fabrications: Steel channel opening frame.

B. Section 08 7100 - Door Hardware: Lock cylinders.

C. Section 26 0533.13 - Conduit for Electrical Systems: Conduit from electric circuit to operator and from operator to control station.

D. Section 26 0583 - Wiring Connections.

1.03 REFERENCE STANDARDS

A. DASMA 102 - American National Standard Specifications for Sectional Overhead Type Doors 2011.

B. ITS (DIR) - Directory of Listed Products current edition.

C. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts 2000, with Errata (2008).

D. NEMA MG 1 - Motors and Generators 2017.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2014.

F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL (DIR) - Online Certifications Directory Current Edition.

H. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations and installation details.

C. Product Data: Show component construction, anchorage method and hardware.

D. Samples: Submit two panel finish samples, indicate sizes, illustrating color and finish.

E. Manufacturer's Installation Instructions: Include any special procedures required by project conditions.

F. Manufacturer's Qualification Statement.

G. Installer's Qualification Statement.

H. Operation Data: Include normal operation, troubleshooting, and adjusting.

I. Maintenance Data: Include data for motor and transmission, shaft and gearing, lubrication frequency, spare part sources.

J. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years documented experience.

C. Comply with applicable code for motor and motor control requirements.

D. Products Requiring Electrical Connection: Listed and classified by ITS (DIR), UL (DIR) or testing firm acceptable to authorities having jurisdiction, as suitable for purpose specified.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals for warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for electric motor and transmission.

D. Provide five year manufacturer warranty for electric operating equipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Other Acceptable Manufacturers - Sectional Doors:

1. C.H.I. Overhead Doors; Model 3295 Aluminum Full-View Doors: www.chiohd.com/#sle.
2. Clopay Building Products; Model 3720: www.clopaydoor.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 STEEL DOORS

A. Steel Doors: Flush steel, insulated; standard lift operating style with track and hardware; complying with DASMA 102, Commercial application.

1. Door Nominal Thickness: [1 3/4] inches ([1.0] mm) thick.

B. Door Panels: Steel construction; outer steel sheet of 1 3/4" minimum thickness, with insulation.

2.03 ALUMINUM DOORS

A. Aluminum Doors: Flush aluminum, insulated; standard lift operating style with track and hardware; complying with DASMA 102, Commercial application.

1. Door Nominal Thickness: as indicated on plans.

B. Door Panels: Flush aluminum construction; outer aluminum sheet; flat profile; core reinforcement of roll formed aluminum; rabbeted weather joints at meeting rails; insulated.

2.04 COMPONENTS

A. Track: Galvanized steel angles, 0.094 inch (2.4 mm) minimum thickness; 2-5/16 x 4 inch (59 x 102 mm) size, continuous one piece per side; galvanized steel mounting brackets 1/4 inch (6 mm) thick.

B. Pass Door: Manufacturers standard, finish to match.

C. Hinge and Roller Assemblies: Heavy duty hinges and adjustable roller holders of galvanized steel; floating hardened steel bearing rollers, located at top and bottom of each panel, each side.

D. Lift Mechanism: Torsion spring on cross head shaft, with braided galvanized steel lifting cables.

E. Sill Weatherstripping: Resilient hollow rubber strip, one piece; fitted to bottom of door panel, full length contact.

F. Jamb Weatherstripping: Roll formed steel section full height of jamb, fitted with resilient weatherstripping, placed in moderate contact with door panels.

G. Head Weatherstripping: EPDM rubber seal, one piece full length.

H. Panel Joint Weatherstripping: Neoprene foam seal, one piece full length.

I. Lock: Inside center mounted, adjustable keeper, spring activated latch bar with feature to retain in locked or retracted position; interior and exterior handle.

J. Lock Cylinders: Keyed alike.

2.05 MATERIALS

A. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G60/Z180 coating, plain surface.

B. Aluminum Sheet: ASTM B209 (ASTM B209M), 5005 alloy, H14 temper, plain surface.

C. Insulation: Foamed-in-place polyurethane, bonded to facing.

2.06 ELECTRIC OPERATION

A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by ITS (DIR), UL (DIR) or testing agency acceptable to authorities having jurisdiction.

1. Provide interlock switches on motor operated units.

B. Electric Operators:

1. Mounting: Side mounted on cross head shaft.
2. Motor Enclosure:
    a. Exterior Doors: NEMA MG 1, Type 4; open drip proof.
    b. Interior Doors: NEMA MG 1, Type 1; open drip proof.
3. Motor Rating: 1/3 hp (250 W); continuous duty.
4. Motor Voltage: 120 volts, single phase, 60 Hz.
5. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
6. Controller Enclosure: NEMA 250, Type 1.
7. Opening Speed: 12 inches per second (300 mm/s).
8. Brake: Adjustable friction clutch type, activated by motor controller.
9. Manual override in case of power failure.
10. Refer to Section 26 0583 for electrical connections.

C. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated; enclose terminal lugs in terminal box sized to comply with NFPA 70.

D. Control Station: Provide standard three button (Open-Close-Stop) momentary-contact control device for each operator complying with UL 325.

1. 24 volt circuit.
2. Surface mounted, at interior door jamb.

3. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.

E. Safety Edge: Located at bottom of sectional door panel, full width; electro-mechanical sensitized type, wired to stop and reverse door direction upon striking object; hollow neoprene covered to provide weatherstrip seal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.

B. Verify that electric power is available and of the correct characteristics.

3.02 PREPARATION

A. Prepare opening to permit correct installation of door unit to perimeter air and vapor barrier seal.

B. Apply primer to wood frame.

3.03 INSTALLATION

A. Install door unit assembly in accordance with manufacturer's instructions.

B. Anchor assembly to wall construction and building framing without distortion or stress.

C. Securely brace door tracks suspended from structure. Secure tracks to structural members only.

D. Fit and align door assembly including hardware.

E. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.

F. Install perimeter trim.

3.04 TOLERANCES

A. Maximum Variation from Plumb: 1/16 inch (1.5 mm).

B. Maximum Variation from Level: 1/16 inch (1.5 mm).

C. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch (3 mm) from 10 ft (3 m) straight edge.

D. Maintain dimensional tolerances and alignment with adjacent work.

3.05 ADJUSTING

A. Adjust door assembly for smooth operation and full contact with weatherstripping.

3.06 CLEANING

A. Clean doors and frames and glazing.

B. Remove temporary labels and visible markings.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

B. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

END OF SECTION

SECTION 08 3800
TRAFFIC DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Double-acting self-closing swinging traffic doors.

B. Door accessories.

C. Door frames.

1.02 RELATED REQUIREMENTS

A. Section 05 5000 - Metal Fabrications: Steel jambs and header.

B. Section 08 1213 - Hollow Metal Frames: Flat-faced frame.

C. Section 08 7100 - Door Hardware: Wall-mounted door stops.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's technical information for each type of door specified, including details about materials, components, profiles, gaskets, and finishes; include:

1. Preparation and installation instructions and methods.
2. Storage and handling requirements and recommendations.
3. Operation and maintenance data.

C. Shop Drawings: Show installation details of doors and frames, including elevations and attachment.

D. Selection Samples: For each finish requiring color selection, submit color samples indicating full line of available colors and finishes.

E. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner 's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing type of work specified in this section with not less than three years of documented experience and approved by manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver product in manufacturer's original unopened packages with label legible and intact.

B. Store doors at project site on edge or in upright position, under cover and elevated above grade, following manufacturer's instructions.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide two year manufacturer warranty for molded polyethylene doors against damage due to worker-ridden vehicle traffic; state limitations in executed warranty.

PART 2 PRODUCTS

2.01 RIGID AND SEMI-RIGID TRAFFIC DOORS

A. Molded Polyethylene Double-Acting Traffic Doors : Integrally molded polyethylene plastic faces and edges with urethane foam fill.

1. Thickness: 1-1/2 inches (38 mm).
2. Faces: 1/8 inch (3 mm) minimum thickness; textured or pebble finish.
3. Construction: Manufacturer's standard construction reinforced for durability and rigidity, with all edges, cut-outs, and hardware preparations factory fabricated; provide view window cut-outs with joints sealed independently of glazing or trim.
4. Hardware Preparations: Factory reinforce, machine, and prepare for all hardware including field installed items; provide solid blocking for each hardware item; make field cutting, drilling or tapping unnecessary.

B. Lightweight Aluminum Double-Acting Traffic Doors : Aluminum sheet with formed or reinforced edges for stiffness.

1. Material: Aluminum sheet, thick, satin anodized finish.

C. Door Assemblies: Provide double-acting, self-closing pairs of doors for installation in frame provided by others; factory fabricated and finished, complete with hinges and specified accessories.

1. Door Swing: Minimum of 90 degrees each direction.
2. Hinges: V-cam gravity hinges at top and pivots at bottom; mounted on bottom of header and on top of floor; maximum rise 1-1/2 inches (38 mm); vertical and horizontal adjustment in the field ; manufacturer's standard lower hinge guards.
3. Hinge Guards: Manufacturer's standard material and configuration, to protect lower hinges from damage.
4. Exposed Metal Parts: Either stainless steel, extruded aluminum, or powder coated.
5. View Windows: Provide view window in each door panel unless otherwise indicated, centered in door width, and 48 inches (1220 mm), maximum, from finish floor to bottom of viewing area.
6. Dimensional Tolerances: Plus or minus 1/4 inch (6 mm) in width and height of each panel.

D. View Windows: Factory installed glazing in molded or extruded black thermoplastic or rubber gasket; centered in door width; use single glazing unless otherwise indicated.

1. Single Glazing: Acrylic glazing sheet, 1/4 inch (6 mm) thick, clear.

2.02 FLEXIBLE TRAFFIC DOORS

A. Transparent Flexible Traffic Doors : Pair of double-acting doors.

1. Material: Clear, flexible polyvinylchloride sheet, 0.12 inch (3 mm) thick; reinforced vinyl header, 1/8 inch (3 mm) thick, affixed on both sides of panel with vinyl cement.
2. Hinges: Top mounted, gravity-operated self-closing hinging system and bracket support for door leaf; no lower hinge.
3. Overlap at Center: 3/4 to 1-1/2 inch (19 to 38 mm).

2.03 ACCESSORY COMPONENTS

A. Frames: Provide doors pre-hung in frames by door manufacturer; tubular steel welded frame.

B. Provide tamper proof fasteners and other hardware as recommended by manufacturer for complete installation.

C. Additional Door Hardware: Specified in Section 08 7100.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that jambs and frames are square and plumb.

B. Verify that opening is ready to receive work and opening dimensions and clearances are as indicated on drawings.

C. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory conditions before proceeding.

D. Commencement of work by installer is acceptance of opening conditions.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

3.03 INSTALLATION

A. Install doors with clearances, anchors, hardware, and accessories according to the manufacturer's instructions and as specified.

B. Install doors plumb, level, and properly aligned.

3.04 ADJUSTING

A. Clean and lubricate operating parts.

B. Adjust doors to open and close smoothly and freely without binding and for proper fit of seals.

3.05 CLEANING

A. Clean surfaces using methods as recommended by manufacturer.

3.06 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 08 4126
ALL-GLASS ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. All-glass entrances.

B. All-glass storefronts.

C. Swinging doors.

D. Interior sliding doors.

E. Interior multi-folding doors.

1.02 RELATED REQUIREMENTS

A. Section 05 4000 - Cold-Formed Metal Framing: Supplementary supports.

B. Section 08 7100 - Door Hardware.

C. Section 09 2116 - Gypsum Board Assemblies.

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2014.

C. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2013.

D. ASTM B455 - Standard Specification for Copper-Zinc-Lead Alloy (Leaded-Brass) Extruded Shapes 2010 (Reapproved 2017).

E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.

F. ASTM C1036 - Standard Specification for Flat Glass 2016.

G. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.

H. BHMA A156.4 - American National Standard for Door Controls - Closers 2013.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene at project site seven calendar days prior to scheduled beginning of construction activities of this section to review section requirements.

1. Require attendance by representatives of installer and entities effected by adjacent or other work related to this section.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's descriptive literature for each component in all-glass entrance assembly.

C. Shop Drawings: Drawings showing layout, dimensions, identification of components, and interface with adjacent construction.

D. Selection Samples: Two sets, representing manufacturer's full range of available metal materials and finishes.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in Maryland.

B. Installer Qualifications: Minimum three years of experience installing entrance assemblies similar to those specified in this section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. All-Glass Entrances and Storefronts:

1. Avanti Systems USA; Eclipse Standard Doors: www.avantisystemsusa.com/#sle.
2. C.R. Laurence Company, Inc; CRL-Blumcraft 1301 Series Entrance System: www.crl-arch.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

B. Fittings and Hardware:

1. Avanti Systems USA; Double Glazed Acoustic Swing Door Hardware: www.avantisystemsusa.com/#sle.
2. DORMA USA, Inc: www.dorma.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ALL-GLASS ENTRANCES AND STOREFRONTS ASSEMBLIES

A. Entrances and Storefronts: Factory fabricated assemblies consisting of frameless glass panels fastened with metal structural fittings in configuration indicated on drawings.

1. Operational Loads: Designed to withstand door operation under normal traffic without damage, racking, sagging, or deflection.
2. Prepared for all specified hardware whether specified in this section or not.
3. Finished metal surfaces protected with strippable film.
4. Factory assembled to greatest extent practicable; may be disassembled to accommodate shipping constraints.

B. Swinging Door Fittings and Hardware:

1. Top and bottom pivots concealed in full width rails top and bottom.
2. Single Doors: Floor mounted door stop.

C. Interior Top Hung Sliding Door Fittings and Hardware:

1. Top Track: Box channel, designed for support of panels of size and weight required.
2. Hangers: Overhead mounted twin roller assembly, concealed within top track, with concealed clamps.
3. Pulls Both Sides: .
4. Floor guides.

D. Interior Bottom Roller Sliding Door Fittings and Hardware:

1. Top and bottom box tracks, designed for support of panels of size and weight required.

2. Roller Assembly: Tandem rollers, concealed within bottom fitting.
3. Pulls Both Sides:
4. Positive stops, both ends.

E. Interior Multi-Folding Door Fittings and Hardware:

1. Top Track: Box channel, design for support of panels of size and weight required.
2. Hangers: Overhead mounted twin roller assembly, attached to pivots concealed in full width top and bottom rails.

2.03 FITTINGS AND HARDWARE

A. Rail Style Fittings for Swinging Doors and Related Fixed Glazing:

B. Patch Style Fittings for Swinging Doors and Related Fixed Glazing:

C. Headers for Swinging Doors and Related Fixed Glazing:

D. Pivot Systems for Glass Swinging Doors:

E. Overhead Concealed Closers and Bottom Pivots for Glass Swinging Doors: Non-handed closer for both single and double-acting doors with mechanical backcheck, and meeting requirements of BHMA A156.4, Grade 1.

1. Application: Center hung, with swing as indicated on drawings.
2. Hold Open: Fixed.
3. Opening Force: Comply with requirements of authorities having jurisdiction.
4. Door Weight: Maximum 200 lbs (91 kgs) for exterior doors, and 250 lbs (113 kgs) for interior doors, including hardware.
5. Provide accessories as required for complete installation, including wall/floor stop.

F. Floor Mounted Concealed Door Closers and Top Pivots for Glass Swinging Doors: Non-handed closer for both single and double-acting doors with mechanical backcheck, and meeting requirements of BHMA A156.4, Grade 1.

1. Application: Center hung, with swing as indicated on drawings.
2. Hold Open: Fixed.
3. Opening Force: Comply with requirements of authorities having jurisdiction.
4. Cover Plate Finish: As indicated.

2.04 BASIS OF DESIGN - FITTINGS AND HARDWARE

A. Rail Style Fittings for Swinging Doors and Related Fixed Glazing:

1. Basis of Design: C.R. Laurence Company, Inc; CRL Wedge-Lock Dry Glaze Door Rail System: www.crl-arch.com/#sle.
    a. Full Length Top Rails:
    b. Full Length Bottom Rails:

B. Patch Style Fittings for Swinging Doors and Related Fixed Glazing:

1. Basis of Design: C.R. Laurence Company, Inc; CRL Wedge-Lock Dry Glaze Patch System: www.crl-arch.com/#sle.

C. No-Rail, No-Patch Style Fittings for Swinging Doors:

D. Locksets and Exit Devices for Glass Doors:

E. Closers for Glass Doors:

F. Locking and Non-Locking Ladder Pulls for Glass Doors:

G. Full Height Handles, Hinges, and Door Closure Hardware:

H. Acoustic Double Glazed Handles, Hinges, Pivots, and Door Closure Hardware:

I. Glazing Accessories for Related Fixed Glazing:

J. Other Manufacturers: Not permitted; provide the product identified as "Basis of Design".

2.05 MATERIALS

A. Glass: Flat glass meeting requirements of ASTM C1036, Type I - Transparent Flat Glass, Quality Q3, and Kind FT, fully tempered, in accordance with ASTM C1048, and as follows:

1. Thickness: 3/8 inch (9.5 mm).
2. Color: Class 1, Clear.
3. Prepare glazing panels for indicated fittings and hardware before tempering.
4. Polish edges that will be exposed in finished work to bright flat polish.
5. Temper glass materials horizontally; visible tong marks or tong mark distortions are not permitted.

B. Aluminum Components: Comply with ASTM B221 (ASTM B221M), Alloy 6063, Temper T5.

C. Stainless Steel Components: Comply with ASTM A666, Type 304.

D. Brass Components: Comply with ASTM B455, UNS C38500, Architectural Bronze.

E. Sealant: One-part silicone sealant, comply with ASTM C920, clear.

2.06 ACCESSORIES

A. Exposed Fittings and Hardware: Stainless steel, brushed finish.

B. Fixed Glazed Panel Fittings: Sufficient to structurally support glazing and doors under specified loads; including but not limited to cover caps for door hardware, glazing mullions, clamp fittings and panel corner patches.

C. Sidelight and Transom Fittings: No rails; provide extruded aluminum channels, for recessed installation in construction above and below glazing panels for frameless appearance.

D. Sliding Door Fittings: Continuous rail at top and bottom of door:

1. Rail Cross-Section: 1-3/4 inches (44.4 mm) wide by 4 inches (101 mm) high.
2. Rail Profile: Tapered.

E. Latching Hardware: Manufacturer's standard flush bolt assemblies, concealed within bottom rail of indicated panels, prepared for lock cylinders specified in 08 7100; recessed dustproof bolt keeper.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings are acceptable.

B. Do not begin installation until substrates and openings have been properly prepared.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean substrates thoroughly prior to installation.

B. Prepare substrates using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Installation of cold-formed metal framing for openings as specified in Section 05 4000.

B. Installation of metal framing for openings as specified in Section 09 2116.

C. Install in accordance with manufacturer's installation instructions.

D. Tolerances:

1. Horizontal Components and Sight Lines: Not more than 1/8 inch in 10 feet (3.2 mm in 3 m) variation from level, non-cumulative.
2. Vertical Components and Sight Lines: Not more than 1/8 inch in 10 feet (3.2 mm in 3 m) variation from plumb, non-cumulative.
3. Variation from Plane or Indicated Location: Not more than 1/16 inch (1.6 mm).

3.04 ADJUSTING

A. Adjust doors to operate correctly, without binding to frame, sill, or adjacent doors.

B. Adjust door hardware for smooth operation.

3.05 CLEANING

A. Clean installed work to like-new condition.

3.06 PROTECTION

A. Protect installed products until Date of Substantial Completion.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 08 4313
ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass.

B. Infill panels of metal and glass.

C. Weatherstripping.

D. Door hardware.

1.02 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware: Hardware items other than specified in this section.

B. Section 08 8000 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site 2015.

B. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems 2015.

C. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems 2014.

D. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document) 2015.

E. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections 2009.

F. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.

G. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.

H. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2014.

I. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2013.

J. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2004 (Reapproved 2012).

K. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference 2014.

L. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference 2000 (Reapproved 2016).

M. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors 2002 (Reapproved 2018).

N. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference 2015.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.

1. Include design engineer's stamp or seal on shop drawings for attachments and anchors.

D. Samples: Submit two samples illustrating finished aluminum surface, glass, infill panels, glazing materials.

E. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

F. LEED Report: Accurately document the use of recycled materials and local/regional materials, as required by Section 01 35 14, Section 01 35 15, Section 01 35 16 and appropriate forms, and Section 01 60 00.

G. LEED Submittals: Provide VOC content documentation for field-applied sealants and primers; comply with VOC content limits of Section 01 61 16.

H. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.

I. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

J. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

K. Designer's Qualification Statement.

L. Manufacturer's Qualification Statement.

M. Installer's Qualification Statement.

N. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner 's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in Maryland.

B. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least five years of documented experience.

C. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.08 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a ten year period after Date of Substantial Completion.

C. Provide ten year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

D. Provide ten year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Aluminum-Framed Storefront and Doors:

1. Kawneer North America: www.kawneer.com/#sle.
2. YKK AP America Inc: www.ykkap.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.

1. Glazing Position: Centered (front to back).
2. Finish: Superior performing organic coatings.
    a. Factory finish all surfaces that will be exposed in completed assemblies.
    b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
3. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
4. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
5. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
6. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
7. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
8. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
9. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel and heel bead of glazing compound.

B. Performance Requirements:

1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.

a. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.

2. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf (390 Pa).

3. Air Leakage Laboratory Test: Maximum of 0.06 cu ft/min sq ft (0.3 L/sec sq m) of wall area, when tested in accordance with ASTM E283 at 6.27 psf (300 Pa) pressure differential across assembly.

4. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.

2.03 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.

1. Glazing Stops: Flush.

B. Glazing: As specified in Section 08 8000.

C. Infill Panels: Insulated, aluminum sheet face and back, with edges formed to fit glazing channel and sealed.

2.04 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Sheet Aluminum: ASTM B209 (ASTM B209M).

C. Fasteners: Stainless steel.

D. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

2.05 HARDWARE

A. For each door, include weatherstripping, sill sweep strip and threshold.

B. Other Door Hardware: As specified in Section 08 7100.

C. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.

D. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Set thresholds in bed of sealant and secure.

J. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inch per 3 feet (1.5 mm per m) non-cumulative or 0.06 inch per 10 feet (1.5 mm per 3 m), whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

3.04 FIELD QUALITY CONTROL

A. Provide services of storefront manufacturer's field representative to observe for proper installation of system and submit report.

B. See Section 01 4000 - Quality Requirements, for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.

C. Water-Spray Test: Provide water spray quality test of installed storefront components in accordance with AAMA 501.2 during construction process and before installation of interior finishes.

1. Perform a minimum of two tests in each designated area as indicated on drawings.

2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.

D. Provide field testing of installed storefront system by independent laboratory in accordance with AAMA 503 during construction process and before installation of interior finishes.

1. Perform a minimum of two tests in each designated area as indicated on drawings.

2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.

3. Field test for water penetration in accordance with ASTM E1105 with uniform static air pressure difference (Procedure A) not less than 4.18 psf (200 Pa).

a. Maximum allowable rate of water penetration in 15-minute test is 0.5 ounce (14 gram) that is not contained in an area with provisions to drain to exterior, or collected on surface of interior horizontal framing member.

4. Field test for air leakage in accordance with ASTM E783 with uniform static air pressure difference of 1.57 psf (75 Pa).

E. Repair or replace storefront components that have failed designated field testing, and retest to verify performance conforms to specified requirements.

3.05 ADJUSTING

A. Adjust operating hardware and sash for smooth operation.

3.06 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.

C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 08 4413
GLAZED ALUMINUM CURTAIN WALLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed curtain wall, with vision glazing and infill panels.

B. Aluminum-framed sloped curtain wall, self-supporting, with vision glazing.

C. Firestopping between curtain wall and edge of floor slab.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Weld plates embedded in concrete for attachment of anchors.

B. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.

C. Section 08 4313 - Aluminum-Framed Storefronts: Entrance framing and doors.

D. Section 08 8000 - Glazing.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site 2015.

B. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems 2014.

C. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document) 2015.

D. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2004 (Reapproved 2012).

E. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference 2014.

F. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference 2015.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, internal drainage details, glazing, and infill.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.

D. Samples: Submit two samples indicate size illustrating finished aluminum surface, glazing, infill panels, and glazing materials.

E. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

F. Design Data: Provide framing member structural and physical characteristics and engineering calculations, and identify dimensional limitations; include load calculations at points of attachment to building structure.

G. Structural Sealant Glazing (SSG): Submit product data and calculations showing compliance with performance requirements.

H. Test Reports: Submit results of full-size mock-up testing. Reports of tests previously performed on the same design are acceptable.

I. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

J. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner 's name and registered with manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.06 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN

A. Other Manufacturers: Provide either product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below.

2.02 CURTAIN WALL

A. Aluminum-Framed Curtain Wall: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.

1. Finish: Class I natural anodized.

    a. Factory finish surfaces that will be exposed in completed assemblies.

    b. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.

2. Provide flush joints and corners, weathersealed, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for imposed loads.

3. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.

4. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

B. Structural Performance Requirements: Design and size components to withstand the following load requirements without damage or permanent set.

1. Design Wind Loads: Comply with the following:

    a. Measure performance by testing in accordance with ASTM E330/E330M, using test loads equal to 1.5 times the design wind loads and 10 second duration of maximum pressure.

2. Movement: Accommodate the following movement without damage to components or deterioration of seals:

a. Expansion and contraction caused by 180 degrees F (82 degrees C) surface temperature.

b. Expansion and contraction caused by cycling temperature range of 170 degrees F (77 degrees C) over a 12 hour period.

c. Movement of curtain wall relative to perimeter framing.

d. Deflection of structural support framing, under permanent and dynamic loads.

C. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on indoor face when tested as follows:

1. Test Pressure Differential: 10 psf (480 Pa).

D. Air Leakage Laboratory Test: Maximum of 0.06 cu ft/min sq ft (0.3 L/sec sq m) of wall area, when tested in accordance with ASTM E283 at 6.27 psf (300 Pa) pressure differential across assembly.

2.03 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.

B. Glazing: As specified in Section 08 8000.

2.04 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

C. Glazing Accessories: As specified in Section 08 8000.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other related work.

B. Verify that curtain wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

C. Verify that anchorage devices have been properly installed and located.

3.02 INSTALLATION

A. Install curtain wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inches every 3 ft (1.5 mm/m) non-cumulative or 0.5 inches per 100 ft (12 mm/30 m), whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

C. Sealant Space Between Curtain Wall Mullions and Adjacent Construction: Maximum of 3/4 inch (19 mm) and minimum of 1/4 inch (6 mm).

3.04 FIELD QUALITY CONTROL

A. Provide services of curtain wall manufacturer's field representative to observe for proper installation of system and submit report.

B. Provide field testing of installed curtain wall system by independent laboratory in accordance with AAMA 503 during construction process and before installation of interior finishes.

1. Perform a minimum of two tests in each designated area as indicated on drawings.
2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.
3. Field test for water penetration in accordance with ASTM E1105 with uniform static air pressure difference (Procedure A) not less than 4.18 psf (200 Pa).
    a. Maximum allowable rate of water penetration in 15-minute test is 0.5 ounce (14 gram) that is not contained in an area with provisions to drain to exterior, or collected on surface of interior horizontal framing member.

C. Repair or replace curtain wall components that have failed designated field testing, and retest to verify performance conforms to specified requirements.

3.05 ADJUSTING

A. Adjust operating sash for smooth operation.

3.06 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, take care to remove dirt from corners, and wipe surfaces clean.

C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 08 4418
GLAZED STEEL CURTAIN WALLS

PART 2 PRODUCTS

1.01 CURTAIN WALL

A. Steel-Framed Curtain Wall: Factory fabricated, factory finished steel framing members with infill, and related flashings, anchorage and attachment devices.

1. Finish of Exposed Steel: Superior performing organic coatings.
    a. Factory finish surfaces that will be exposed in completed assemblies.
    b. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
2. Finish of Exposed Aluminum: Class I natural anodized.
    a. Factory finish surfaces that will be exposed in completed assemblies.
    b. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
3. Provide flush joints and corners, weathersealed, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for imposed loads.
4. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
5. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

1.02 PERFORMANCE REQUIREMENTS

A. Structural Performance Requirements: Design and size components to withstand the following load requirements without damage or permanent set.

1. Design Wind Loads: Comply with the applicable code.
2. Movement: Accommodate the following movement without damage to components or deterioration of seals:
    a. Expansion and contraction caused by 180 degrees F (82 degrees C) surface temperature.
    b. Expansion and contraction caused by cycling temperature range of 170 degrees F (77 degrees C) over a 12 hour period.
    c. Movement of curtain wall relative to perimeter framing.
    d. Deflection of structural support framing, under permanent and dynamic loads.

B. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on indoor face when tested as follows:

1. Test Pressure Differential: 10 lbs per sq ft (480 Pa).

C. Air Leakage Laboratory Test: Maximum of 0.06 cu ft/min/sq ft (0.3 L/s/sq m) of wall area, when tested in accordance with ASTM E283 at 6.27 lbs per sq ft (300 Pa) pressure differential across assembly.

1.03 COMPONENTS

A. Glazing: As specified in Section 08 8000.

1.04 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.

B. Superior Performance Organic Coating System: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride system.

C. Touch-Up Materials: As recommended by coating manufacturer for field application.

END OF SECTION

SECTION 08 4435
PROTECTIVE FRAMED GLAZING ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior protective framed glazing assembly.

B. Interior protective framed glazing assembly.

1.02 RELATED REQUIREMENTS

A. Section 05 1200 - Structural Steel Framing: Steel attachment members.

B. Section 07 8400 - Firestopping: Firestop at exterior wall assembly junction with structure.

C. Section 08 7100 - Door Hardware: Hardware installation requirements.

D. Section 08 7100 - Door Hardware.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site 2015.

B. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems 2015.

C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2014 (2015 Errata).

D. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.

E. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).

F. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2018c.

G. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2004 (Reapproved 2012).

H. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference 2014.

I. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference 2000 (Reapproved 2016).

J. ASTM E413 - Classification for Rating Sound Insulation 2016.

K. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings 2016.

L. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2019.

M. UL 263 - Standard for Fire Tests of Building Construction and Materials Current Edition, Including All Revisions.

N. UL 752 - Standard for Bullet-Resisting Equipment Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by each affected installer.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide evidence of compliance with fire performance criteria and manufacturer's published product data on framing components, glazing, anchorage and fasteners, and doors, if any.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.

D. Samples: Submit samples as follows illustrating each exposed metal finish of interior and exterior project-specific applications.

1. For color anodized aluminum, submit minimum of three samples illustrating expected range of color in actual production.

2. For factory-finished steel members, submit minimum of three color selection samples.

E. Design Data: Provide framing member structural and physical characteristics and engineering calculations, and identify dimensional limitations.

F. Design Data: Submit framing member structural and physical characteristics and engineering calculations, and identify dimensional limitations.

G. Test Reports: Submit results of full-size mock-up testing for criteria other than fire performance. Reports of tests previously performed on the same design are acceptable.

H. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

I. Field Quality Control Submittals: Submit report of field testing for water leakage.

J. Installer's Qualification Statement.

K. Designer's Qualification Statement.

L. Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Perform design under direct supervision of a Professional Structural Engineer experienced in design of this type of work and licensed in Maryland.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with at least ten years documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to substrate when exposed to sunlight or weather.

1.08 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C), and maintain above this minimum temperature during and for 48 hours after installation.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

D. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 EXTERIOR PROTECTIVE FRAMED GLAZING ASSEMBLIES

A. Fabricators - Single Story Walls:

B. Provide factory fabricated, factory finished framing members with glazing and related flashings, anchorage and attachment devices.

1. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" within internal spaces.

2. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

C. Fire Performance: Provide hourly fire-resistance-rating as indicated; tested as an assembly including glazing in compliance with ASTM E119 or UL 263 and requirements of local authorities having jurisdiction.

1. Acceptable evidence of compliance includes listing by UL (DIR), ITS (DIR) or testing agency acceptable to authorities having jurisdiction.

D. Structural Performance: Design and size components to withstand the following loading without damage or permanent set.

1. Design Live Loads: Comply with requirements of the following:

a. Measure performance by testing in accordance with ASTM E330/E330M, using test loads equal to 1.5 times the design wind loads and 10 second duration of maximum pressure.

2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.

3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths or 3/4 inch (19 mm), whichever is less, under specified design load.

4. Movement: Accommodate the following movement without damage to components or deterioration of seals:

a. Expansion and contraction caused by 180 degrees F (82 degrees C) surface temperature.

b. Expansion and contraction caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period.

c. Movement of wall relative to perimeter framing.

d. Deflection of structural support framing, under permanent and dynamic loads.

E. Water Penetration: No uncontrolled water on indoor face when tested as follows:

1. Test Pressure Differential: 10 pound-force per square foot (480 Pa).

F. Air Leakage: Maximum of 0.06 cu ft/min/sq ft (0.3 L/s/sq m) of wall area, when tested in accordance with ASTM E283 at 6.27 pounds per square foot (300 Pa) pressure differential across assembly.

2.02 INTERIOR PROTECTIVE FRAMED GLAZING ASSEMBLIES

A. Provide factory fabricated, factory finished framing members with glazing and related flashings, anchorage and attachment devices.
   1. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
   2. Preparation for Window Treatments: Provide reinforced interior horizontal head rail.

B. Structural Performance: Design to support dead loads and horizontal live loads equivalent to the following; coordinate connection to main structural members.
   1. Design Live Loads: Comply with requirements of the following:
      a. Positive Design Live Load: .
      b. Negative Design Live Load: .
      c. Measure performance by testing in accordance with ASTM E330/E330M, using test loads equal to 1.5 times the design loads and 10 second duration of maximum pressure.
   2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
   3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths or 3/4 inch (19 mm), whichever is less, under specified design load.

C. Fire Performance: Provide hourly fire-resistance-rating as indicated; tested as an assembly including glazing in compliance with ASTM E119 or UL 263 and requirements of local authorities having jurisdiction.
   1. Acceptable evidence of compliance includes listing by UL (DIR), ITS (DIR) or testing agency acceptable to authorities having jurisdiction.

D. Acoustical Performance: Substantiate acoustical performance using test sample identical to system being specified, including glazing.
   1. Sound Attenuation: STC of 45, minimum, both directions.
   2. Test Method: ASTM E90, with calculation in accordance with ASTM E413.

2.03 DOORS AND HARDWARE

A. Doors: Glazed hollow steel.
   1. Thickness: 1-3/4 inches (44.5 mm).
   2. Top Rail: 4 inches (102 mm) wide.
   3. Vertical Stiles: 4-1/2 inches (114.3 mm) wide.
   4. Bottom Rail: 6 inches (152 mm) wide.
   5. Glazing Stops: Square.
   6. Finish: Same as framing.

B. Door Hardware:
   1. Types: As specified in Section 08 7100.
   2. Finish on Hand-Contacted Items: Polished chrome.

C. Interior Doors:
   1. Hinges: Butt type, swing clear; top and bottom.

2. Closers: .

2.04 FINISHES

A. Finishing: Apply factory finish to surfaces that will be exposed in completed assemblies.

1. Touch-up surfaces cut during fabrication so that no natural metal surfaces are visible in completed assemblies, including joint edges.

B. Aluminum Finish: Class I natural anodized.

1. Apply factory finish to surfaces that will be exposed in completed assemblies.

2. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.

C. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

C. Verify that anchorage devices have been properly installed and located.

3.02 INSTALLATION

A. Install wall system in accordance with limitations of fire rating and with manufacturer's instructions.

B. Install framed glazing assemblies in accordance with NFPA 80 and requirements of local authorities having jurisdiction.

C. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

D. Provide alignment attachments and shims to permanently fasten system to building structure.

E. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

F. Provide thermal isolation where components penetrate or disrupt building insulation.

G. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

H. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

I. Install firestopping at each floor slab edge.

J. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

K. Set door thresholds in bed of mastic and secure.

L. Install door hardware using templates provided.

1. See Section 08 7100 for hardware installation requirements.

M. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 1/16 inch every 3 feet (1.6 mm every 0.914 m) non-cumulative or 1/2 inch per 100 ft (12.7 mm per 30.5 m), whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

C. Sealant Space Between Mullions and Adjacent Construction: Maximum of 3/4 inch (19 mm) and minimum of 1/4 inch (6.4 mm).

3.04 FIELD QUALITY CONTROL

A. Refer to Section 01 4000 - Quality Requirements, for independent testing and inspection requirements. Inspection will monitor quality of installation and glazing.

B. Exterior Walls: Test installed wall for water leakage in accordance with AAMA 501.2 hose test.

C. Replace components that have failed field testing and retest until performance is satisfactory.

3.05 ADJUSTING

A. Adjust doors for smooth operation.

3.06 CLEANING

A. Remove protective material from pre-finished surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 08 4500
TRANSLUCENT WALL AND ROOF ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Self supporting aluminum framed vertical glazing system.

B. Sandwich panels of translucent skins separated with an aluminum grid.

C. Insulated metal infill panels.

1.02 RELATED REQUIREMENTS

A. Section 08 5113 - Aluminum Windows.

B. Section 08 8000 - Glazing.

1.03 REFERENCE STANDARDS

A. AAMA CW-DG-1 - Aluminum Curtain Wall Design Guide Manual 1996 (R2005).

B. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site 2015.

C. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems 2015.

D. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections 2009.

E. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2017.

G. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.

H. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.

I. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2014.

J. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2013.

K. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).

L. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2004 (Reapproved 2012).

M. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference 2014.

N. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference 2000 (Reapproved 2016).

O. ASTM E413 - Classification for Rating Sound Insulation 2016.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, panel configuration, internal drainage details and [_____].

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, weep drainage network, expansion and contraction joint location and details, and field welding required.

D. Samples: Submit two samples illustrating prefinished aluminum surface, specified panel with skins, glazing materials illustrating edge and corner.

E. Design Data: Show structural and physical characteristics, engineering calculations, and dimensional limitations.

F. Test Reports: Submit substantiating engineering data, test results of previous tests by independent laboratory which purport to meet performance criteria, and other supportive data.

G. Installation Data: Special installation requirements.

H. Designer's Qualification Statement.

I. Manufacturer's Qualification Statement.

J. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with AAMA CW-DG-1.

1. Maintain one copy on project site.

B. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in Maryland.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

D. Installer Qualifications: Company specializing in performing the work of this section with at least three years of documented experience.

1.06 MOCK-UP

A. Provide mock-up, include translucent panels, intermediate mullion. Assemble to illustrate component assembly including glazing materials, weep drainage system, attachments, anchors, and perimeter sealant.

B. Mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Handle work of this section in accordance with AAMA CW-10.

B. Protect prefinished aluminum surfaces with wrapping; do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.

1. Puncture wrappings at ends for ventilation.

1.08 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C).

B. Maintain this minimum temperature during and after installation of sealants.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Other Acceptable Sandwich Panel Translucent Wall and Roof Assemblies Manufacturers:

1. Enduro Composites, Inc; Tuff Span Translucent Structural Daylighting Panels: www.endurocomposites.com/#sle.
2. Kalwall: www.kalwall.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. System Design: Design and size components to withstand dead loads and live loads caused by snow, hail, and positive and negative wind loads acting on plane of panel without damage or permanent set.

1. Design Loads: Calculate in accordance with applicable code.
2. Measure performance in accordance with ASTM E330/E330M, using test load of 1.5 times the design wind pressure and 10 second duration of maximum load.

B. Deflection: Limit mullion deflection to 3/4 inch (19 mm) with full recovery of glazing materials.

C. System Assembly: Accommodate without damage to system, components or deterioration of seals; movement within system; movement between system and perimeter framing components; dynamic loading and release of loads; deflection of structural support framing, tolerance of supporting components, shortening of building concrete structural columns.

D. Sound Attenuation Through Wall System (Exterior to Interior): STC of 45, minimum, calculated in accordance with ASTM E413, tested in accordance with ASTM E90.

E. Air Infiltration: Limit air infiltration through assembly to 0.06 cu ft/min sq ft (0.30 L/sec sq m) of sloped glazed area, measured at a reference differential pressure across assembly of 1.57 psf (75 Pa) as measured in accordance with ASTM E283.

F. Static Pressure Vapor Seal: Provide vapor seal that maintains interior static pressure of at least 1 inch (25.4 mm) water column (WC) at 72 degrees F (22 degrees C) and 40 percent relative humidity.

G. Condensation Resistance Factor (CRF): Minimum required in accordance with AAMA 1503.

H. Water Leakage: None, when measured in accordance with ASTM E331 at a test pressure difference of 2.86 lbf/sq ft (140 Pa).

I. Expansion / Contraction: System to provide for expansion and contraction within system components caused by a cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental effect to system components.

J. System Internal Drainage: Drain water entering joints, condensation occurring in framing system, or migrating moisture occurring within system, to the exterior by a weep drainage network.

K. Fabricate to prevent vibration harmonics, thermal movement transmitted to other building elements, and loosening, weakening, or fracturing of attachments or components of system.

2.03 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Sheet Aluminum: ASTM B209 (ASTM B209M).

C. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

D. Steel Sections: ASTM A36/A36M; shaped to suit mullion sections.

E. Fasteners: Stainless steel.

2.04 COMPONENTS

A. Translucent Wall and Roof System: Structurally reinforced translucent panels, with self supporting framing, shop fabricated, factory prefinished, battens, cap strips, related flashings, anchorage and attachment devices.

B. Panels: Bonded to both sides of structural extruded aluminum grid of pattern as indicated; exposed surfaces of exterior sheet chemically and permanently treated to protect against surface erosion and extreme weather conditions; ; polyvinyl fluoride film coated.

C. Operable Sash: Specified in Section 08 5113.

D. Glazing Materials for Operable Sash: As specified in Section 08 8000.

E. Sealant for Within Translucent Assembly: As required by manufacturer.

F. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, and compatible with flashing material.

2.05 FABRICATION

A. Fabricate system components with minimum clearances and shim spacing around perimeter of assembly, and ensure proper installation and dynamic movement of perimeter seals.

B. Accurately fit and secure joints and corners. Make joints flush, hairline and weatherproof.

C. Prepare components to receive fabricated anchor devices.

D. Locate fasteners and attachments to ensure concealment from view.

E. Reinforce framing members for external imposed loads.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify wall openings and adjoining air barrier and vapor retarder materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install translucent panel system with cells vertical in accordance with manufacturer instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances and align with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings.

G. Coordinate installation of air stop at edge of construction.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Install operating sash glass in accordance with Section 08 8000, to glazing method required to achieve performance criteria.

J. Install infill panels in accordance with Section 08 8000, to glazing method required to achieve performance criteria.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inches every 3 ft (1.5 mm/m) non-cumulative or 0.5 inches per 100 ft (12 mm/30 m), whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

C. Sealant Space Between Panel System Members and Adjacent Construction: Maximum of 3/4 inch (19 mm) and minimum of 1/4 inch (6 mm).

3.04 FIELD QUALITY CONTROL

A. Provide the services of the manufacturer's field representative to observe installation and make report.

B. Inspection will monitor quality of installation and glazing.

C. Test installed curtain wall for water leakage in accordance with AAMA 501.2.

D. Replace curtain wall components that have failed field testing and retest until performance is satisfactory.

3.05 ADJUSTING

A. Adjust operating sash for smooth operation.

3.06 CLEANING

A. Remove protective material from prefinished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths; remove dirt from corners and wipe surfaces clean.

3.07 PROTECTION

A. Protect finished work from damage until Date of Substantial Completion.

END OF SECTION

SECTION 08 5113
ALUMINUM WINDOWS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Extruded aluminum windows with fixed sash, operating sash and infill panels.

B. Factory glazing.

C. Operating hardware.

D. Insect screens.

1.02 RELATED REQUIREMENTS

A. Section 05 5000 - Metal Fabrications: Steel lintels.

B. Section 06 1000 - Rough Carpentry: Rough opening framing.

C. Section 07 2500 - Weather Barriers: Sealing frame to weather barrier installed on adjacent construction.

D. Section 07 9200 - Joint Sealants: Sealing joints between window frames and adjacent construction.

1.03 REFERENCE STANDARDS

A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for windows, doors, and skylights 2017.

B. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site 2015.

C. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections 2009.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

E. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.

F. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.

G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2014.

H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2013.

I. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2004 (Reapproved 2012).

J. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference 2000 (Reapproved 2016).

K. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights 2007 (Reapproved 2016).

1.04 SUBMITTALS

A. Product Data: Provide component dimensions, information on glass and glazing, internal drainage details and descriptions of hardware and accessories.

B. Shop Drawings: Indicate opening dimensions, elevations of different types, framed opening tolerances, method for achieving air and vapor barrier seal to adjacent construction, anchorage locations, and installation requirements.

C. Samples: Submit two samples, 12 by 12 inch (300 by 300 mm) in size illustrating typical corner construction, accessories, and finishes.

D. Submit two samples of operating hardware.

E. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Preinstallation Meetings

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review and discuss the finishing of aluminum windows that is required to be coordinated with the finishing of other aluminum work for color and finish matching.
3. Review, discuss, and coordinate the interrelationship of aluminum windows with other exterior wall components. Include provisions for anchorage, flashing, sealing perimeters, and protecting finishes.
4. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
5. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.06 MOCK-UPS

A. General

1. Mock up of the window configurations, colours & finishes, as well as samples of the associated hardwares and accessories should be made available in the factory for reference.
2. Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
5. Conduct performance test of mockup after approval of visual aspects has been obtained. Testing is to be performed on mockup according to requirements in “Field Quality Control” Article.

B. Mock-up Construction

1. Standard windows:
    a. Construct mock-up showing each typical window type (including emergency windows) section installed in wall opening. Accepted mock-up may form part of complete work.
    b. Allow two (2) working days for inspection of mock-up by Owner’s Representative before proceeding with window work.

c. When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of finished work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of AAMA CW-10.

B. Protect finished surfaces with wrapping paper or strippable coating during installation. Do not use adhesive papers or sprayed coatings that bond to substrate when exposed to sunlight or weather.

1.08 WARRANTY

A. Correct defective Work within a ten year period after Date of Substantial Completion.

B. Provide ten year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

C. Provide ten year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN - AW PERFORMANCE CLASS WINDOWS

A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 having Performance Class of AW, and Performance Grade at least as high as specified design pressure.

2.02 BASIS OF DESIGN - CW PERFORMANCE CLASS WINDOWS

A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 having Performance Class of CW, and Performance Grade at least as high as specified design pressure.

2.03 MANUFACTURERS

A. Basis of Design: Subject to compliance with requirements, provide the following or approved equal product..

1. Fixed, Hopper, Casement Window: Traco NX-Series Thermal
2. Storefront Window: Kawneer Trifab VG
3. Curtain Wall Window: Kawneer 1600 Wall System 1

B. Source Limitations: Obtain aluminum windows from single source manufacturer.

C. Acceptable Manufacturers:

1. EFCO, a Pella Company: www.efcocorp.com/#sle.
2. Kawneer, an Arconic Company; www.kawneer.com
3. YKK AP America Inc: www.ykkap.com/#sle.

2.04 WINDOWS

A. Aluminum Windows:

1. Operating Types:
   a. Fixed
   b. Hopper
   c. Casement
   d. Storefront
   e. Curtain Wall

2. Frames and Sashes: Aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.
    a. Thermally Improved Construction: Fabricate frames, and sashes with an integral, concealed, low-conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal-to-metal contact.
3. Insulating-Glass Units: ASTM E 2190, certified through IGCC as complying with requirements of IGCC.
    a. Glazing Basis of Design: 1⁄4” PPG Solarban 60 clear glass / 1⁄2” Argon Gas 95%, Air 5% / 1⁄4” clear glass
    b. Glass: ASTM C 1036, Type 1, Class 1, q3.
        1) Tint: Clear.
        2) Lites: See Drawings.
        3) Low-E Coating: Pyrolytic on second surface.
4. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.
5. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion- resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.
    a. Exposed Hardware Color and Finish: As selected by Architect from manufacturer's full range.
6. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
    a. Exposed Fasteners: Do not use exposed fasteners to the greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.05 PERFORMANCE REQUIREMENTS

A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific window type:
    1. Performance Class (PC): R.
    2. Performance Grade (PG): 15, with minimum design pressure (DP) of 15.04 psf (720 Pa).

B. Water Leakage: No uncontrolled leakage on interior face when tested in accordance with ASTM E331 at differential pressure of 12.11 psf (580 Pa).

C. Air Leakage: Maximum of 0.1 cu ft/min sq ft (0.5 L/sec sq m) per unit area of outside frame dimension, with 6.27 psf (300 Pa) differential pressure when tested in accordance with ASTM E283.

D. Condensation Resistance Factor of Frame: 50, measured in accordance with AAMA 1503.

E. Overall Thermal Transmittance (U-value): .35, maximum, including glazing, measured on window sizes required for this project.

F. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.55.

2.06 ACCESSORIES

A. Sub sills: Thermally broken, extruded-aluminum sub sills.

B. Interior Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

2.07 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

B. Sheet Aluminum: ASTM B209 (ASTM B209M), 5005 alloy, H12 or H14 temper.

C. Concealed Steel Items: Profiled to suit mullion sections; galvanized in accordance with ASTM A123/A123M.

2.08 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Aluminum Finishes: Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes. Color: Clear Anodized Aluminum.

2.09 FABRICATION

A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Glaze aluminum windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

E. Provide water-shed members above side-hinged sashes and similar lines of natural water penetration.

F. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, per manufacturer’s requirements. Provide mullions and cover plates capable of withstanding design wind loads of window units.

G. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install windows, hardware and other components in accordance with manufacturer's instructions.

B. Install windows in accordance with ASTM E2112.

C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

D. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.

E. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.

F. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

3.03 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

B. Testing Services: Testing and inspecting of installed windows shall take place as follows:

1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502.

2. Air-Infiltration Testing:

a. Test Pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.

b. Allowable Air-Leakage Rate: 1.5 times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.

3. Water-Resistance Testing:

a. Test Pressure: Two-thirds times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.

b. Allowable Water Infiltration: No water penetration.

4. Testing Extent: Three windows of each type as selected by Architect and a qualified independent testing and inspecting agency. Windows shall be tested after perimeter sealants have cured. 5. Test Reports: Prepared according to AAMA 502.

C. Remove and replace noncomplying windows and retest as specified above.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

E. Prepare test and inspection reports.

3.04 ADJUSTING, CLEANING AND PROTECTION

A. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

1. Keep protective films and coverings in place until final cleaning.

B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

C. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

END OF SECTION

SECTION 08 5313
VINYL WINDOWS

PART 2 PRODUCTS

1.01 DESCRIPTION

A. Vinyl Windows: Factory fabricated frame and sash members of extruded, hollow, ultra-violet-resistant, polyvinyl chloride (PVC) with integral color; with factory-installed glazing, hardware, related flashings, anchorage and attachment devices.

1. Configuration: As indicated on drawings.

a. Product Type: AP - Awning projected window, C - Casement window, DW - Dual windows, FW - Fixed window, H - Hung window, vertically sliding, HS - Horizontal sliding window and [_____] in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.

2. Color: Tan.

3. Size to fit openings with minimum clearance around perimeter of assembly providing necessary space for perimeter seals.

4. Framing Members: Fusion welded corners and joints, with internal reinforcement where required for structural rigidity; concealed fasteners.

5. System Internal Drainage: Drain to exterior side by means of weep drainage network any water entering joints, condensation within glazing channel, or other migrating moisture within system.

6. Glazing Stops, Trim, Flashings, and Accessory Pieces: Formed of rigid PVC, fitting tightly into frame assembly.

1.02 COMPONENTS

A. Glazing: Insulated double pane, annealed glass, clear, low-E coated, argon filled, with glass thicknesses as recommended by manufacturer for specified wind conditions and acoustic rating indicated.

B. Frame Depth: 2-11/16 inch (68.3 mm).

END OF SECTION

SECTION 08 6223
TUBULAR SKYLIGHTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tubular skylights, consisting of skylight dome, reflective tube, and diffuser assembly.

1.02 RELATED REQUIREMENTS

A. Section 26 0583 - Wiring Connections: Electrical connections.

1.03 REFERENCE STANDARDS

A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for windows, doors, and skylights 2017.

B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.

C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.

D. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2004 (Reapproved 2012).

E. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference 2000 (Reapproved 2016).

F. UL (DIR) - Online Certifications Directory Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.
4. ICC-ES evaluation report.

C. Shop Drawings: Indicate configurations, dimensions, locations, fastening methods, and installation details.

D. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:

1. Evidence of AAMA Certification.
2. Evidence of WDMA Certification.
3. Evidence of CSA Certification.
4. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.

E. Test Reports: Prior to submitting shop drawings or starting fabrication, submit test report(s) by independent testing agency showing compliance with performance requirements in excess of those prescribed by specified grade.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than ten years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Skylights: Manufacturer's standard warranty for 10 years.

C. Electrical Parts: Manufacturer's standard warranty for three years, unless otherwise indicated.

PART 2 PRODUCTS

2.01 TUBULAR SKYLIGHTS

A. Tubular Skylights: Transparent roof-mounted skylight dome and curb, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces.

1. Fabrication and assembly of components is by single manufacturer.
2. Non-Metal Parts: Flammability less than the following.
    a. Roof-Top Components: Class B when tested in accordance with ASTM E108 or UL 790.
    b. Combustibility - Light Transmitting Parts: Minimum 2.5 inches/min (64 mm/min) (ICC Class CC-2), when tested in accordance with ASTM D635.
3. Thermal Movement: Fabricate to allow for thermal movement resulting from temperature differential from minus 30 to 180 degrees F (minus 34 to 82 degrees C) without damage to components, fasteners, or substrates.

B. Roof Assemblies: Transparent, UV and impact resistant dome with flashing base supporting dome and top of tube.

1. Glazing: Acrylic plastic, 1/8 inch (3.2 mm) minimum thickness.
2. Dome Ring: Attached to top of base section; 0.090 inch (2.3 mm) nominal thickness injection molded high impact ABS; to prevent thermal bridging between base flashing and tubing and channel condensed moisture out of tubing; weather seal of medium density pile weather stripping.

C. Reflective Tube: ASTM B209 (ASTM B209M) aluminum sheet, thickness between 0.015 inch (0.4 mm) and 0.020 inch (0.5 mm).

1. Interior Finish: Exposed interior surfaces of high reflectance specular finish; specular reflectance of 92, total reflectance 95 percent.
2. Tube Configuration and Length: As indicated on the drawings.

D. Diffuser Assemblies: Supporting light transmitting surface at bottom termination of tube, with compression seal to minimize condensation and bug or dirt infiltration.
   1. Ceiling Ring: Edge trim for ceiling opening; injection molded high impact ABS.
   2. Diffuser Trim: Edge and attachment trim for diffuser lens; injection molded high impact ABS.
   3. Diffuser Shape at Solid Ceilings: Round, same diameter as tube.
   4. Lens: Flush frosted lens.
   5. Lens Material: Acrylic plastic.
   6. Visible Light Transmission (VLT): 90 percent, minimum.
   7. Seal: Closed cell EPDM foam rubber.

2.02 PERFORMANCE REQUIREMENTS

A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific tubular skylight:
   1. Product Type: Tubular Daylighting Device, Closed Ceiling (TDDCC).

B. Design Pressure (DP): In accordance with applicable codes.

C. No permanent deflection in excess of 0.2 percent of span.

D. Air Infiltration: Maximum 0.10 cu ft/min sq ft (0.5 L/sec sq m) per unit area of outside frame dimension at 6.27 psf (300 Pa) pressure differential when tested in accordance with ASTM E283.

E. Water Resistance: No uncontrolled water leakage at 6.27 psf (300 Pa) pressure differential with water rate of 5 gallons/h/sf (206 L/h/sq m), when tested in accordance with ASTM E331; design to ensure that water will not accumulate inside assembly.

2.03 ACCESSORIES

A. Fasteners: Same material as metals being fastened, non-magnetic steel, non-corrosive metal of type recommended by manufacturer, or injection molded nylon.

B. Sealant: Elastomeric, silicone or polyurethane; compatible with materials being sealed.

C. Lighting Fixtures: Bracket mounted inside skylight tube just above diffuser; UL (DIR) listed.
   1. Type: Compact fluorescent fixture, for 26 W lamps, 1 lamp per tube.
   2. Electrical Requirements: 110 V, 15 amp GFCI circuit.
   3. Contractor to furnish lamps.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's written instructions.

B. Set roof assembly flashing in continuous bead of sealant.

C. Seal joints exposed to weather in accordance with sealant manufacturer's written instructions.

D. Conduct field test for water tightness; conduct water test in presence of Architect . Correct defective work and re-test until satisfactory.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 08 6300
METAL-FRAMED SKYLIGHTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum skylight framing system.

B. Skylight glazing.

C. Fasteners, anchors, reinforcement, and flashings.

1.02 RELATED REQUIREMENTS

A. Section 05 1200 - Structural Steel Framing: Structural support framing for system.

B. Section 05 5000 - Metal Fabrications: Fabricated steel attachment devices.

C. Section 06 1000 - Rough Carpentry: Wood support curbs.

D. Section 07 6200 - Sheet Metal Flashing and Trim: Skylight counterflashing.

E. Section 07 9200 - Joint Sealants: Sealing joints between skylight frames and adjacent construction.

F. Section 08 8000 - Glazing.

1.03 REFERENCE STANDARDS

A. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems 2014.

B. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document) 2015.

C. ASTM D4479/D4479M - Standard Specification for Asphalt Roof Coatings - Asbestos-Free 2007, with Editorial Revision (2012).

D. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2004 (Reapproved 2012).

E. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference 2014.

F. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference 2000 (Reapproved 2016).

G. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference 2015.

H. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's specifications, standard details, and installation requirements.

C. Shop Drawings: Indicate framed opening requirements and tolerances, spacing of members, anticipated deflection under load, affected related work, expansion and contraction joint locations and details, and sizes and locations for field welding.

1. Show field measurements on shop drawings.

D. Shop Drawings: Provide details of proposed structural sealant glazing (SSG) and weather sealant joints indicating dimensions, materials, bite, thicknesses, profile, and support framing.

E. Selection Samples: Submit full range of aluminum finish samples for Architect 's color selection.

F. Samples: Submit two samples, not less than 12 by 12 inch (300 by 300 mm) in size illustrating appearance of prefinished aluminum and specified glazing system, including glazed edge and corner.

G. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

H. Design Data: Provide framing member structural and physical characteristics and engineering calculations, and identify dimensional limitations.

I. Structural Glazing Adhesive: Submit product data and calculations showing compliance with performance requirements.

J. Test Reports: Submit results of full-size mock-up testing. Reports of tests previously performed on the same design are acceptable.

K. Manufacturer's Installation Instructions: Indicate special procedures, safety precautions, and perimeter conditions requiring special attention.

L. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

M. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

N. Designer's Qualification Statement.

O. Manufacturer's Qualification Statement.

P. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design skylight system under direct supervision of a professional engineer experienced in design of system type specified and licensed in Maryland.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with not fewer than three years of documented experience.

C. Full-Size Mock-up Testing: Have a specimen representative of project conditions tested by an independent testing agency for compliance with specified structural, air infiltration, water penetration and thermal criteria.

D. Verify that each component is appropriate for use in structural sealant glazing (SSG) application in regards to at least the following properties; size, shape, dimensions, material, shelf-life, storage conditions, and color.

E. Installer Qualifications: Company specializing in performing the type of work specified in this section with at least three years of documented experience.

1.06 MOCK-UP

A. See Section 01 4000 - Quality Requirements, for general requirements for mock-ups.

B. Construct mock-up that includes examples of materials and conditions required in finished skylight installation.

C. Locate where directed by Architect.

D. Mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Provide wrapping to protect prefinished aluminum surfaces. Do not use adhesive papers or spray coatings that bond when exposed to sunlight or weather.

1.08 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work, including leaks, discoloration, failure of seal at insulated glazing units, and excessive thermal or structural movement, within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty for insulated glass units from seal failure, interpane dusting or misting, and replacement of same. Include coverage for degradation of color finish.

PART 2 PRODUCTS

2.01 METAL-FRAMED SKYLIGHTS

A. Metal Framed Skylights: Factory-fabricated, and glazed.

1. Frame: Extruded aluminum structural members with integral condensation collection and guttering system thermally separated from exterior pressure bar.
2. Glazing System: Pressure glazing bar system for sloped joints and two (2)-sided structural sealant glazing (SSG) for horizontal joints.
3. Glazing: Insulating glass.
4. Aluminum Finish: High performance organic coatings.
5. Fabricate to prevent vibration harmonics, thermal movement transmitted to other building elements, and loosening, weakening, or fracturing of attachments or components of system.

2.02 PERFORMANCE REQUIREMENTS

A. Provide metal-framed skylights that comply with the following:

1. Structural Design: Design and size components to withstand dead loads and specified live loads without damage or permanent set.
2. Wind Loads: Test in accordance with ASTM E330/E330M, using loads 1.5 times the specified design pressures and 10 second duration of maximum load.
3. Design Pressure (DP): In accordance with applicable codes.
4. Concentrated Load: Design to withstand 250 lb (114 kg) concentrated load at any location on framing members without permanent set.
5. Glazing Support Member Deflection Under Wind Load: 1/180 of span, maximum.
6. Structural Glazing Adhesive: Design system to limit stress on structural glazing adhesive to 20 percent of tested tensile adhesion and maximum compression or elongation to 25 percent of neutral dimension.
7. Thermal Movement: Design system to accommodate thermal expansion and contraction over ambient temperature range of 100 degrees F (38 degrees C), dynamic loading and release of loads, creep of concrete structural members and deflection of structural support framing without damage to skylight system components or loss of weathertightness.
8. Energy Code Compliance: Comply with ICC (IBC), ASHRAE Std 90.1 I-P or the authorities having jurisdiction as required for metal-framed skylights.

9. Air Leakage Laboratory Test: Limit air infiltration through assembly to 0.06 cu ft/min/sq ft (0.3 L/s/sq m) for glazed area, measured at a reference differential pressure across assembly of 1.57 psf (75 Pa) in accordance with ASTM E283.
10. Structural Sealant Glazing (SSG) System: For individual glass lites, design framing members to not exceed a deflection normal to the wall of L/175 between supports with 3/4 inch (19 mm) maximum, and a deflection parallel to the wall of L/360 with 1/8 inch (3.2 mm) maximum, whichever is less.
11. Water Penetration: None, when measured in accordance with ASTM E331 at a test pressure difference of 2.86 lbs per sq ft (140 Pa).

2.03 MATERIALS

A. Aluminum Extrusions: Alloy and temper 6063-T5, 6063-T6, or 6061-T6 members complying with ASTM B221 (ASTM B221M), with minimum thickness 1/8 inch (3.2 mm) for structural members and 1/16 inch (1.6 mm) for non-structural members.

B. Formed Aluminum: Sheet material of alloy 5052, 5005, or 6061-T651 members complying with ASTM B209 (ASTM B209M), with minimum thickness 1/8 inch (3.2 mm) for structural members and 1/16 inch (1.6 mm) for non-structural members.

C. Internal Reinforcement: ASTM A36/A36M Steel shapes as required for strength and mullion size limitations, hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.

D. Glass: Type specified in Section 08 8000.

E. Weatherseal Sealant: Silicone, with adhesion in compliance with ASTM C794; compatible with glazing accessories.

F. Protective Back Coating: Asphaltic mastic, ASTM D4479/D4479M Type I.

G. Fasteners: Stainless steel.

H. Flashing: Matching finish of skylight frame system components; secure using un-concealed fastening method, and seal with weather-tight sealant.

2.04 FABRICATION

A. Rigidly fit and secure joints and corners with screw and spline; fabricate rigid joints with connections that are flush, hairline, and weatherproof.

B. Fabricate components to allow for expansion and contraction with minimum clearance and shim spacing around perimeter of assembly.

C. Drain to exterior any water entering exterior joints, condensation occurring in glazing channels, or migrating moisture occurring within system.

D. Prepare components to receive concealed anchorage devices, and ensure that fasteners will be concealed upon completion of installation.

E. Adhere glass to glazing frames with structural adhesive and cure under controlled conditions in shop. Field glazing of frames to glass is not acceptable.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that structural curb is ready to receive skylight system. Coordinate installation of roofing and other adjacent work to ensure weathertight construction.

3.02 PREPARATION

A. Apply 1 coat of protective coating to concealed aluminum and steel surfaces in contact with dissimilar materials.

3.03 INSTALLATION

A. Install metal-framed skylights in accordance with manufacturer's instructions.

B. Set skylight structure plumb, level, and true to line, without warp or rack of frames or glazing panels. Anchor securely in place in accordance with approved shop drawings.

C. Maintain assembly dimensional tolerances, aligning with adjacent work.

D. Install base flashings in accordance with Section 07 6200.

E. Install glazing in accordance with Section 08 8000.

F. Structural Sealant Glazing (SSG) Adhesive: Install structural sealant glazing adhesive and weather-tight sealant in accordance with manufacturer's instructions.

G. Touch up damaged finishes so repair is imperceptible from 6 feet (1.8 m) distance, and remove and replace components that cannot be acceptably touched up.

3.04 TOLERANCES

A. Maximum Variation from Plumb, Level, or Line: 1/8 inch per 10 feet (1 mm per 1 m), or 3/8 inch (9.5 mm) total in overall dimension.

B. Alignment of Two Adjoining Members Abutting in Plane: Within 1/16 inches (1.6 mm).

3.05 FIELD QUALITY CONTROL

A. Provide services of metal-framed skylight manufacturer's field representative to observe for proper installation of system and submit report.

B. See Section 01 4000 - Quality Requirements, for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.

C. Provide field testing of installed metal-framed skylights by independent laboratory in accordance with AAMA 503 during construction process and before installation of interior finishes.

1. Perform a minimum of two tests in each designated area as indicated on drawings.
2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.
3. Field test for water penetration in accordance with ASTM E1105 with uniform static air pressure difference (Procedure A) not less than 4.18 psf (200 Pa).
    a. Maximum allowable rate of water penetration in 15-minute test is 0.5 ounce (14 gram) that is not contained in an area with provisions to drain to exterior, or collected on surface of interior horizontal framing member.

D. Repair or replace metal-framed skylight components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.06 CLEANING

A. Upon completion of installation, thoroughly clean skylight aluminum surfaces in accordance with AAMA 609 & 610.

B. Remove protective material from prefinished aluminum surfaces.

C. Wash down exposed surfaces; wipe surfaces clean.

D. Remove excess sealant by methods recommended by skylight manufacturer.

END OF SECTION

SECTION 08 7100
DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for wood, aluminum, hollow metal and [_____] doors.

B. Hardware for fire-rated doors.

C. Electrically operated and controlled hardware.

D. Lock cylinders for doors that hardware is specified in other sections.

E. Thresholds.

F. Weatherstripping and gasketing.

G. Gate locks.

1.02 RELATED REQUIREMENTS

A. Section 06 2000 - Finish Carpentry: Wood door frames.

B. Section 06 4100 - Architectural Wood Casework: Cabinet hardware.

C. Section 07 9200 - Joint Sealants: Sealants for setting exterior door thresholds.

D. Section 08 0671 - Door Hardware Schedule: Schedule of door hardware sets.

E. Section 08 1113 - Hollow Metal Doors and Frames.

F. Section 08 1116 - Aluminum Doors and Frames.

G. Section 08 1416 - Flush Wood Doors.

H. Section 08 1423 - Clad Wood Doors.

I. Section 08 1433 - Stile and Rail Wood Doors.

J. Section 08 1613 - Fiberglass Doors.

K. Section 08 1700 - Integrated Door Opening Assemblies.

L. Section 08 1753 - Integrated Glass Door Opening Assemblies.

M. Section 08 3223 - Sliding and Folding Glazed Walls and Doors: Door hardware, except cylinders.

N. Section 08 3323 - Overhead Coiling Doors: Door hardware, except cylinders.

O. Section 08 3326 - Overhead Coiling Grilles: Door hardware, except cylinders.

P. Section 08 3613 - Sectional Doors: Door hardware, except cylinders.

Q. Section 08 4313 - Aluminum-Framed Storefronts: Door hardware, except as noted in section.

R. Section 08 4413 - Glazed Aluminum Curtain Walls: Door hardware, except cylinders.

S. Section 08 4426 - Structural Glass Curtain Walls: Door hardware, except cylinders.

T. Section 10 1400 - Signage: Additional signage requirements.

U. Section [_____]: Power supply to electric hardware devices.

V. Section 10 2600 - Wall and Door Protection: Door and frame protection.

W. Section 28 1000 - Access Control: Electronic access control devices.

X. Section 28 4600 - Fire Detection and Alarm: Electrical connection to activate door closers.

Y. Section [_____]: Building monitoring system.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

B. BHMA (CPD) - Certified Products Directory 2017.

C. BHMA A156.1 - American National Standard for Butts and Hinges 2016.

D. BHMA A156.2 - American National Standard for Bored and Preassembled Locks & Latches 2017.

E. BHMA A156.3 - American National Standard for Exit Devices 2014.

F. BHMA A156.4 - American National Standard for Door Controls - Closers 2013.

G. BHMA A156.5 - American National Standard for Cylinders and Input Devices for Locks 2014.

H. BHMA A156.6 - American National Standard for Architectural Door Trim 2015.

I. BHMA A156.7 - American National Standard for Template Hinge Dimensions 2016.

J. BHMA A156.8 - American National Standard for Door Controls - Overhead Stops and Holders 2015.

K. BHMA A156.12 - American National Standard for Interconnected Locks 2013.

L. BHMA A156.13 - American National Standard for Mortise Locks & Latches Series 1000 2017.

M. BHMA A156.14 - American National Standard for Sliding and Folding Door Hardware 2013.

N. BHMA A156.15 - American National Standard for Release Devices - Closer Holder, Electromagnetic and Electromechanical 2015.

O. BHMA A156.16 - American National Standard for Auxiliary Hardware 2013.

P. BHMA A156.17 - American National Standard for Self Closing Hinges & Pivots 2014.

Q. BHMA A156.18 - American National Standard for Materials and Finishes 2016.

R. BHMA A156.20 - American National Standard for Strap and Tee Hinges, and Hasps 2006 (Reaffirmed 2012).

S. BHMA A156.21 - American National Standard for Thresholds 2014.

T. BHMA A156.22 - American National Standard for Door Gasketing and Edge Seal Systems, Builders Hardware Manufacturers Association 2017.

U. BHMA A156.23 - American National Standard for Electromagnetic Locks 2010.

V. BHMA A156.24 - American National Standard for Delayed Egress Locking Systems 2012.

W. BHMA A156.25 - American National Standard for Electrified Locking Devices 2013.

X. BHMA A156.26 - American National Standard for Continuous Hinges 2012.

Y. BHMA A156.28 - American National Standard for Recommended Practices for Mechanical Keying Systems 2013.

Z. BHMA A156.30 - American National Standard for High Security Cylinders 2014.

AA. BHMA A156.31 - American National Standard for Electric Strikes and Frame Mounted Actuators 2013.

BB. BHMA A156.36 - American National Standard for Auxiliary Locks 2016.

CC. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames 2016.

DD. BHMA A156.115W - Hardware Preparation in Wood Doors with Wood or Steel Frames 2006.

EE. DHI (H&S) - Sequence and Format for the Hardware Schedule 1996.

FF. DHI (KSN) - Keying Systems and Nomenclature 1989.

GG. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames 2004.

HH. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors 1993; also in WDHS-1/WDHS-5 Series, 1996.

II. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

JJ. ITS (DIR) - Directory of Listed Products current edition.

KK. NEMA LD 3 - High-Pressure Decorative Laminates 2005.

LL. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

MM. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2019.

NN. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

OO. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives 2016.

PP. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2017.

QQ. UL (DIR) - Online Certifications Directory Current Edition.

RR. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.

SS. UL 437 - Standard for Key Locks Current Edition, Including All Revisions.

TT. UL 1784 - Standard for Air Leakage Tests of Door Assemblies Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.

B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

C. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; attendance is required by affected installers and the following:

1. Architect.
2. Installer's Architectural Hardware Consultant (AHC).
3. Hardware Installer.
4. Owner's Security Consultant.

D. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

E. Keying Requirements Meeting:

1. Owner will schedule meeting at project site prior to Contractor occupancy.
2. Attendance Required:
    a. Contractor.
    b. Owner.
    c. Architect.

d. Installer's Architectural Hardware Consultant (AHC).

e. Hardware Installer.

f. Owner's Security Consultant.

3. Agenda:

a. Establish keying requirements.

b. Verify locksets and locking hardware are functionally correct for project requirements.

c. Verify that keying and programming complies with project requirements.

d. Establish keying submittal schedule and update requirements.

4. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:

a. Access control requirements.

b. Key control system requirements.

c. Schematic diagram of preliminary key system.

d. Flow of traffic and extent of security required.

5. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

6. Deliver established keying requirements to manufacturers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.

C. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.

1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).

2. Comply with DHI (H&S) using door numbers and hardware set numbers as indicated in construction documents.

a. Submit in vertical format, refer to Section 08 0671.

3. List groups and suffixes in proper sequence.

4. Provide complete description for each door listed.

5. Provide manufacturer's and product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.

6. Include account of abbreviations and symbols used in schedule.

D. Shop Drawings - Electrified Door Hardware: Submit diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:

1. Prepared by or under supervision of Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC).

2. Elevations: Submit front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.
3. Diagrams: Submit point-to-point wiring diagram that shows each device in door opening system with related colored wire connections to each device.

E. Samples for Verification:

1. Submit minimum size of 2 by 4 inch (51 by 102 mm) for sheet samples, and minimum length of 4 inch (102 mm) for other products.
2. Submit one (1) sample of hinge, latchset, lockset, closer and [_____] illustrating style, color, and finish.
3. Return full-size samples to Contractor.
4. Submit product description with samples.

F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

G. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

1. Submit manufacturer's parts lists and templates.
2. Bitting List: List of combinations as furnished.

H. Keying Schedule:

1. Submit three (3) copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.

I. Manufacturer's Qualification Statement.

J. Installer's Qualification Statement.

K. Supplier's Qualification Statement.

L. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

M. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.

N. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Lock Cylinders: Ten for each master keyed group.
3. Tools: One set of each special wrench or tool applicable for each different or special hardware component, whether supplied by hardware component manufacturer or not.

1.06 QUALITY ASSURANCE

A. Standards for Fire-Rated Doors: Maintain one copy of each referenced standard on site, for use by Architect and Contractor.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.

D. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC) to assist in work of this section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Warranty against defects in material and workmanship for period indicated, from Date of Substantial Completion.

1. Closers: Five years, minimum.
2. Exit Devices: Three years, minimum.
3. Locksets and Cylinders: Three years, minimum.
4. Other Hardware: Two years, minimum.

PART 2 PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.

B. Provide individual items of single type, of same model, and by same manufacturer.

C. Provide door hardware products that comply with the following requirements:

1. Applicable provisions of federal, state and local codes.
2. Fire-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
3. Hardware on Fire-Rated Doors: Listed and classified by UL (DIR), ITS (DIR), testing firm acceptable to authorities having jurisdiction or [_____] as suitable for application indicated.
4. Hardware for Smoke and Draft Control Doors (Indicated as "S" on Drawings): Provide door hardware that complies with local codes, and requirements of assemblies tested in accordance with UL 1784.
    a. Air Leakage Rate: Tested in accordance with UL 1784, with air leakage rate not to exceed 3.0 cfm/sf (0.01524 cu m/sec/sq m) of door opening at 0.10 inch (24.9 Pa) of water for both ambient and elevated temperature tests.
5. Listed and certified compliant with specified standards by BHMA (CPD).
6. Auxiliary Hardware: BHMA A156.16.
7. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
8. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.
9. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.

D. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's series. Refer to Section 08 0671 for listing of hardware sets.

E. Fasteners:

1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
    a. Aluminum fasteners are not permitted.
    b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
2. Provide machine screws for attachment to reinforced hollow metal and aluminum frames.
    a. Self-drilling (Tek) type screws are not permitted.
3. Provide wall grip inserts for hollow wall construction.
4. Provide spacers or sex bolts with sleeves for through bolting of hollow metal doors and frames.
5. Fire-Rated Applications: Comply with NFPA 80.
    a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
    b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.

2.02 HINGES

A. Manufacturers:
    1. Hager Companies; [_____]: www.hagerco.com/#sle.
B. Hinges: Comply with BHMA A156.1, Grade 1.
    1. Provide hinges on every swinging door.
    2. Provide following quantity of butt hinges for each door:

2.03 FINISHES

END OF SECTION

SECTION 08 7100
FINISH HARDWARE

PART I - GENERAL

1.01 BID INFORMATION

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to the work specified in this section.

B. Products of finish hardware supplied shall only be selected from manufacturers mentioned in this document. Hardware specified herein shall be considered precedent, and no substitutions will be entertained. The Owner, however, reserves the right to make changes at any time.

1.02 DESCRIPTION OF WORK:

A. Refer to drawings, schedules and details for items requiring finish hardware. It is the intention of this section to include all finishing hardware required for the project, except for items which are specifically noted as being furnished elsewhere. Items not specifically mentioned, but necessary/required or consistent with other like conditions, must be furnished and shall be the same as like items of hardware specified.

B. Furnish all labor, materials, tools, equipment and services necessary to complete the hardware work, as indicated on the drawings, specified, and as necessary or required to satisfactorily complete the project.

C. Work includes furnishing of all finish hardware items necessary to complete the work shown on the drawings, except for those items specified to be provided under other sections of this specification. Work includes, but is not limited to, the following:

1. Lock cylinders and keying.
2. Locks and latches.
3. Padlocks for roof hatches and mechanical/electrical gates.
4. Push/Pull plates.
5. Exit devices and panic hardware.
6. Flush bolts.
7. Floor closers and pivots.
8. Surface closers.
9. Hinges and butts/spring hinges.
10. Stops.
11. Protective plates.
12. Thresholds.
13. Weather-stripping, gasketing and silencers.
14. Fasteners.
15. Grills and screens.
16. Saddles at joints in building and doors.
17. Sliding door hardware.
18. Bifold door hardware.
19. Hold open hardware.

20. Automatic door seal (door bottom).
21. Astragels/Meeting seals.
22. Electrical security hardware.
23. Smoke detectors.
24. Continuous gear hinge.
25. Removable mullions.
26. Miscellaneous control devices
27. Sound stripping

D. Work Specified Elsewhere: Work specified to be provided under other sections include the following:

1. Hardware for metal windows.
2. Hardware for toilet partitions.
3. Toilet accessories.
4. Hardware for operable walls and accordion partitions.
5. Venetian blind hardware.
6. Graphics (name plates).
7. Stair treads.
8. Handrail hardware.
9. Corner guards.
10. Access door hardware.
11. Electrical system wiring.
12. Hardware for lockers.
13. Hardware for factory built cabinets and casework.
14. Hardware for unit kitchen.
15. Hardware for elevators.
    a. Miscellaneous hardware

1.03 QUALITY ASSURANCE:

A. The hardware supplier/installer shall, in the opinion of the Owner, have sufficient comparable experience (not less than five years) and an organization consisting of experienced members of The Door and Hardware Institute with Architectural Hardware Consultant status to property handle, detail and service the hardware in a satisfactory manner. The supplier shall have in stock at all times sufficient material to take care of shortages and minor extras without delay. The supplier shall maintain a warehouse and office in the Washington Metropolitan area (75 mile radius) and be readily available to attend job meetings that may be required by the architect, Owner or general contractor. The definition of the Washington Metropolitan area is at the discretion of the Owner, and he reserves the right to exclude any supplier who, he feels, is too far away to provide proper service.

B. The hardware supplier shall examine all drawings, schedules, details and relevant shop drawings, and furnish all hardware to suit. The supplier shall obtain all information required as to details, sizes, shapes, bevel thickness, etc. of doors and other items requiring hardware and make all hardware suitable for and of perfect fit as to type, style, size, thickness, hand, function, finish, etc. for each particular case. Where

practical applications cannot be made with the exact types of hardware specified, obtain the Owner's and Architect's permission to furnish suitable types having the same operative and functional features. Hardware for application on metal doors and frames and premortised wood doors shall be made for standard templates and necessary template information furnished as required. Inform contractor promptly of estimated time and dates that will be required to process submittals, to furnish templates, to deliver hardware, and to perform other work associated with furnishing door hardware for purposes of including this date in construction schedule. Comply with this schedule.

1.04 ALL ITEMS TO BE NEW & IN GOOD CONDITION, FREE OF DEFECTS.

1.05 SUBMITTALS:

A. Submit five copies of a complete "Hardware Schedule" and product data showing all hardware to be furnished and the location for which it is intended to the Architect for review. A cover sheet shall be made part of the hardware schedule and shall list manufacturer of each item of hardware, hardware mounting heights, explanation of abbreviations, symbols, codes, etc. The schedule shall include all items required for the entire project and shall cover details as to proper type of strike plates, length of spindle, hand, backset and bevel of locks, hand and degree of opening for closers, length of kickplates, length of rods and flush bolts, type of door stop and other necessary information. The contractor shall assume sole responsibility for the provisions, proper coordination and function of the finish hardware required for all openings, whether or not hereinafter listed in the detail schedule. The Architect's and Owner's review of the hardware schedule shall not be construed as a complete check, nor shall it relieve the Contractor from responsibility for any errors, deviations or omissions from the requirements needed to satisfactorily complete the project.

B. Submit schedule at earliest possible date, particularly where acceptance of hardware schedule must precede fabrication of other work that is critical in the project construction schedule. Allow three weeks for review after the Owner receives the schedule. Include with schedule the product data, samples, shop drawings of other work affected by door hardware, and other information essential to the coordinated review of schedule.

C. Upon review and return of the finish hardware schedule, the hardware supplier will make corrections within two weeks and furnish necessary copies of detailed schedules and location of items to all parties concerned. Hardware supplier will also furnish product technical data sheets for each item of hardware, necessary template information and such other detailed information relative to the installation and maintenance of operating parts of this hardware to all who need them. List the hardware set number as well as the manufacturer's set number. Organize final hardware schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:

1. Type, style, function, size, and finish of each hardware item.
2. Name and manufacturer of each item.
3. Fastening and other pertinent information.
4. Location of each hardware set cross-referenced to indications on drawings, both on floor plans and in door and frame schedule.
5. Explanation of all abbreviations, symbols, and codes contained in schedule.
6. Mounting locations for hardware.
7. Door and frame sizes and materials.
8. Keying information.
    a. Samples of the specified hardware shall be submitted for approval to the Owner.

1.06 COORDINATION:

A. The hardware supplier shall consult the project drawing and details and otherwise familiarize themselves with the work to the end that all items of hardware furnished shall conform to units to which it is applied. He/she shall coordinate the hardware with other conflicting trades such as millwork metal doors and frames, etc. All doors, door hardware, and door frames are to be coordinated by ONE supplier. Any problem with delivery, interfacing or installation is the sole responsibility of the general contractor and their supplier.

B. Immediately after the award of the hardware purchase order, it shall be the duty of the Contractor to request approved shop drawings from such trades with which the hardware must be coordinated.

C. After receiving approved shop drawings, the Contractor shall promptly supply all template information, template drawings, approved hardware schedules, etc., as may be required to facilitate the progress of the job.

1.07 CONTRACTOR IS RESPONSIBLE FOR ALL MEANS, METHODS, COORDINATION AND SEQUENCING FOR THE PROJECT.

1.08 CODE CONFORMANCE:

A. Finish hardware shall conform with all applicable codes and regulations, including requirements of:

1. ANSI 4.139
2. NFPA 80 - Fire Doors and Windows
3. NFPA 101 - Life Safety Code
4. Local and State Building Codes
5. UL Labeled for Rated Doors
6. DHI - Door and Hardware Institute
7. SDI - Steel Door Institute
8. AWI - Architectural Woodwork Institute
9. 9. IBC - International Building Code (Amended 2003)

1.09 FIRE-RATED OPENINGS:

A. Where doors are indicated as labeled assemblies, provide only hardware which has been tested and listed by UL for the type, sizes, functions and labels of doors and frames shown or otherwise required by local code, in compliance with the BOCA-National Building Code (Amended), American Insurance Association, Pamphlet No. 80 and NFPA, Standard No. 80, current editions. This requirement takes precedence over other requirements for such hardware specified.

PART 2 - PRODUCTS

2.01 HINGES

A. Template: Provide template produced units only that are manufactured in accordance with ANSI/BHMA A156.1-1988 Standards.

B. Continuous Gear Hinge: All exterior doors shall have continuous gear hinges except to boiler rooms and outside storage rooms. Also provide continuous gear hinges on interior doors to multipurpose rooms, gymnasiums, auditoriums and media centers. Continuous gear hinges must be listed for use on 90-minute fire doors and frames as a minimum. Provide products from the following list of manufacturers:

Roton (Hager) #780-224HD

McKinney #MCK-24HD

Marka Products, Inc., ~~#HG-315~~ (DELETED & REPLACE BY #FM 2011)

C. Full Mortise Hinge: All remaining doors shall have heavyweight (minimum.190 ga.) hinges: five knuckle, four ball bearing, dull chrome (26D), full mortise type hinges.

D. Size: Provide 4 1/2" x 4-1/2" hinges on doors to closets. Provide 4 1/2" x 4-1/2" hinges on all other doors also.

E. Number of Hinges: Provide a minimum of three hinges for doors 90" or less in height and one additional hinge for each 30" of additional height.

F. Screws: Provide manufacturer's standard screws. Use self-drilling structural fasteners (Drill Flex) to secure continuous hinges to grout-filled metal frames.

G. Half Surface Hinge: Provide half-surface hinges on all fire-rated wood, mineral core doors. Use sleeve nuts and machine bolts (sex bolts) and 3" x 5" x .097 stainless steel protection plates to prevent crushing of the core materials and finished surface of the door, such as Hager No. 418.

H. Quality: Provide top commercial grade products from the following list.

1. Hager Hinge Co.
2. McKinney Products Co.
3. Stanley Hardware, Division Stanley Works.
4. Bommer Industries, Inc.

2.02 LOCKS, CYLINDERS AND KEYING:

A. LOCKS AND LATCHES:

B. Locks: All locks shall be heavy-duty, ANSI A156.13 1000 Series certified for operational Grade 1 and Security Grade 2 and UL-labeled for use on fire doors up to and including three hours. All "Primary" locksets must be lever action and be able to accept small format I/C core 6 cylinders. All keys and cylinders shall be grade one high security. Primary locksets shall be keyed to Owner's specified keyway. All "Emergency" access locksets shall be "Best" lever handle to safeguard against accidental entry into unsafe areas such as mechanical, electrical, storage spaces etc. Provide locksets less manufacturer's cylinders. Contractor to provide and install all small format I/C cylinders, cores and keys that have been keyed to the Owner's specification. Use six-lobe Torx security screws with center pin at all exposed connections. Provide strike plates with curved face edges and metal strike boxes behind strike plates. Provide locksets from the following list:

1. PRIMARY - INTERIOR LOCKSETS:
2. Provide one of the following locksets for all interior doors (except doors to emergency access areas - Mechanical and Electrical Rooms).

SSI Guardian QAL Mortise Lock

Model - E

Function - M1

26D = Satin chrome finish

2.03 EMERGENCY ACCESS:

A. Provide locksets as listed below for all mechanical, electrical rooms, computer and telephone wiring hubs, Boiler Room doors and all other maintenance related doors.

B. **BEST 9K CYLINDRICAL LEVER LOCK**

9K = Heavy duty cylindrical lever lock

7 = 7 pin core

D = Storeroom function

14D = Curved lever handle with curved return

26D = Satin chrome finish

AL = Abrasive lever (not on front door)

C. ALL EXTERIOR DOORS to have one 3-1/2” x 15” stainless steel pull plate with finger pull at the bottom of the plate, installed on the outside and exit devices on the inside.

1. Exceptions:

a. Provide one “primary” lockset with cylinder, core and AC keying in one of the main Entrance doors. Provide a primary lockset for one door of all main entrance lobbies to gymnasiums, auditoriums, etc., where singular use of those spaces will be accessed during hours when the school is closed. **Locksets and keying is to be determined by the Owner in tandem with any applicable MNCPP requirements.**

b. Provide one “primary” lockset with cylinder, core and AC keying in the exterior door to the food service (kitchen) suite.

c. Provide one “emergency access” lockset with “Best” cylinder, core and keying at the exterior entrance to the boiler room.

2.04 REST ROOMS LOCKSETS: MORTISE DEADBOLTS

A. Multi-Person Toilets (All Persons):

Push-Pull Plates: Ives No. 8302 3 ½ x 15

Ives No. 8200 3 ½ x 15

1. Deadbolt Above Latch: Classroom Function

Sargent No. 470

Schlage B Series

Corbin Russwin No. DL3100

B. Single Person Toilets (All Persons):

1. All single person toilets will have a Bathroom function lockset installed with an emergency access cylinder. A secondary lockset with double cylinders and a thumbturn is necessary to provide privacy and security.

a. Privacy Bathroom Lever Lockset: Bathroom Function

Sargent 11-Line

Schlage ND-Series

Corbin Russwin CL-3300 Series

b. Deadbolt Above Lockset: Double Deadbolt Public Toilet Function

Sargent No. 470

Shclage B Series

Corbin Russwin No. DL3100

2.05 KEYING

A. **General: Contractor’s hardware supplier will meet with the Architect and Owner’s representative to ensure that all hardware instructions are understood and to mark up two (2) sets of**

architectural floor plans to record the proposed keying assignments. Any deviation from the instructions in this Specification must be made during this meeting and approved in writing by the Owner.

B. All newly constructed schools and all total renovations will have small format I/C cylinders to accept a 7 pin core installed into “primary” locksets. All keying will be set up on a three-submaster key system as outlined below (in Middle Schools and High Schools, **additional sub-masters may be added at the discretion of the Owner. No Grand Master keys are to be made or used.** The hardware supplier/installer will be notified of any additions at the Keyset meeting per #1 above.). Replace all existing lockset cylinders with small format I/C cylinders and cores and provide specified number of keys and new key cabinet(s).

C. At existing schools where small additions or small renovations are being constructed, it will be necessary to match the existing keying system in all new doors and provide a key cabinet for the new keys.

D. **AA Master Key:** Cleaning Master - Used to access **most interior spaces**. The following spaces are to be keyed to the “A-A” Master:

1. All classrooms - All hall doors to a classroom (or common space) are to be keyed alike.
2. Between Classrooms (Lockset in doors between adjoining classrooms to be double-keyed and keyed different. Cylinder in adjoining classroom keyed to adjoining classroom’s corridor cylinder, this does not apply to shared: science prep rooms.)
3. Multipurpose Room
4. Library
5. Main Office - Hall door(s) only (except as noted in Best Keying, B-7)
6. All Administrative Offices (except Principal’s Office)
7. Health Room
8. Gymnasium (except as noted in B-2)
9. Toilet Rooms (single and multi-person)
10. Kitchen Serving Line
11. Kitchen Office
12. Custodial Closets (Also see AC Keying B-6 & Best Keying B-7)
13. Courtyards

E. AB Master Key - Used to access large storage rooms. Used to access storage rooms and closets which contain low or medium value items. This key will access the Principal’s closet; classroom closets and all other closets. Refer to AC for exceptions.

F. AC Master Key - Used to access small storage rooms. Used to access storage rooms housing high value items located both inside and outside the building. Refer to Best for exceptions. Used to access the following:

1. Front Door to Main Lobby
2. A.V. Equipment from interior
3. Science Prep Rooms
4. Custodian Main Supply Room from interior
5. Physical Education Equipment - Inside plus outside keyed differently
6. Entrance to Kitchen from outside

7. Kitchen Food Storage Room from interior
8. Outside Storage Rooms
9. Music Storage
10. School Storage
11. Main Office Vault and Guidance Records Vault
12. Health Room Medicine Storage Closet
13. Principal's Office

G. Best Keying System - Emergency access master. Used to open and lock-up the facility and for emergency access by maintenance crews after hours. Provide Best lockset with Best 7 pin core. See 2.2A-2. Used to access the following:

1. Boiler Room Interior Hall and Exterior Doors
2. Security and Fire Alarm Rooms
3. Electrical and Generator Rooms (with or without storage capacity)
4. Padlocks for roof hatches, generator and air conditioning unit gates
5. All Interior Corridors
6. All Mechanical Rooms and Roof
7. Telephone and Computer Wiring Hubs and P.A. Equipment Rooms
8. Gate to Generator and Propane Compound
9. Backflow preventers
10. Main Entrance - see below*
11. Main Office - see below*
12. *One main entrance door is to be added to the Best keying section.

H. one main office door, closest to the P.A. room will be added to the best keying section. in addition, one main office door, closet to the p.a room will be keyed with a best core and cylinder.

1. Note: No. 7 may not be applicable if the above rooms/spaces are not provided within small additions and/or classroom additions.

I. Exterior doors shall NOT be keyed (no cylinders) on the exterior side, except as previously mentioned (Section 2.03 C-1), including the exterior kitchen entrance, exterior boiler room entrance, and the main front door entrance). All non-keyed doors to the exterior shall have code approved push bar hardware on the inside and vandal proof pull handles on exterior (except as noted in section 2.03 C-1).

J. Equip all locksets with construction cores for temporary use during construction. Key construction cores as directed by the contractor. Hardware supplier to return all temporary construction cores to lockset manufacturer if requested or required by manufacturer.

K. Permanent Keys and Cylinders. Pin all small format I/C cores and cut all keys at the factory only. Five change keys will be provided for each lockset supplied. Permanently emboss one side of the key bows with DO NOT DUPLICATE and the other side with the key control numbers (AA-1; AC-10; etc.). All permanent cylinder parts shall be stainless steel and nickel silver. All cylinders and keys are to be shipped directly to the Contractor, who is responsible for the security and installation of these items into the door locksets. Installation work will be performed by a certified locksmith. It will include the cylinder

installation per the Keyset information and inspection of the completed lockset and cylinder for proper function per the manufacture.

L. **Permanent “Best” Keys and Cylinders. Prior to acceptance of the building, the Contractor will pay for and arrange to have the Best Access Systems supply the Owner with the quantities of “Best” pinned cylinders and cut keys that will be needed to fulfill the requirements of Section 2.2 B-7. In addition, the Contractor will pay for and arrange to have the Best Access Systems supply the Owner with the quantities of “Best” pinned cylinders and cut keys over and above what is needed for Section 2.2 B-7 as stated below:**

1. **Elementary Schools - 20 cylinders and 10 keys**
2. **Middle Schools - 30 cylinders and 15 keys**
3. **High Schools - 40 cylinders and 20 keys**

M. These cylinders and keys shall be prepared in accordance with the Owner’s existing system. Instruct the Best Access Systems to ship this part of the hardware directly to the Owner’s locksmith at:

Prince George’s County Public Schools

Facilities Service Base

4801 Brown Station Road

Upper Marlboro, Maryland 20772

Attention: Carpentry Shop Locksmith

Indicate the project name on the package.

N. The Owner’s locksmith will install the Best cylinders into the new locksets as indicated on the key meeting floor plan drawing. A construction core control key will be provided to the Owner’s locksmith by the Contractor.

The General Contractor must make the request for the installation of the Best system by calling 301-952-6500.

O. Key Management. The Contractor will provide and install a complete key management and storage system to house all of the door keys, all of the built-in casework keys (all casework keys are to be mastered and keyed differently) and all of the mechanical equipment keys. The Contractor will organize, label, record and install all of the keys into the key cabinet(s) before delivery to the construction site. The Contractor must implement a key management system to manage all casework keys. Organize key cabinet(s) and cross-index by room numbers, codes, and hook. The Contractor is solely responsible for the security of the keys and the key cabinet(s) until the site is turned over to the Owner. He will record the final permanent room numbers, the architectural door number, the key hook number, the Keyset number and the key bitting in the cross-index loan register book. Provide three (3) complete hard copies of the register book and the bitting chart.

Provide a two collar key tag system: one red with “MUST NOT BE LOANED” with one key permanently attached and one white with the remaining four keys attached on a removable snap hook, both to have consecutive hook numbers stamped into them. No plastic tags will be accepted.

Provide two (2) sets of hook numbers: one for the red-tagged keys and one for the white-tagged keys. All door keys are to be tagged, with the final room number on one side and the hook number on the other side. Place the four (4) white-tagged keys on hooks in the upper section of the cabinet(s). Place the red-tagged keys on hooks in the lower section of the cabinets(s), leaving the last drawer(s) empty for lock and key storage.

Provide grade “A” type file drawer key cabinet(s) with individual drawer locks keyed different and mastered keyed (only three master keys to the cabinet are to be supplied and delivered to the Owner) with full extension drawers, standard base and all necessary components. Provide removable slide-out panels with single row numbering and key hooks. Provide products from the following list:

	Elementary Provide one Cab. No.	Middle Provide one Cab. No.	High Provide two Cab. No.
Key Control Systems:	6L2205	8L3003	8L3003
Telkee Inc.:			
Lund Inc.:			

P. Mobile key cabinet Security: The grade “A” type file cabinet(s) for keys must be mobile and a permanent anchoring system for the cabinet is to be established in the main office vault. A permanent masonry wall or floor mounted anchor capable of accepting a length of 5/0 chain must be incorporated into the construction of the vault. The anchor must be located near the vault entrance while still maintaining unimpeded access to the vault. The mobile key cabinet must have a similar hard point welded or otherwise permanently attached to the rear of the cabinet that will accept a section of 5/0 chain. The wall/floor mount and the cabinet mount must withstand a pulling force of 500 PSI. At the time of delivery of the cabinet to the building, the Contractor will schedule a meeting with the Owner to secure the cabinet in the vault. The Owner’s will supply the padlock to secure the chain to the wall and cabinet. At this meeting the Contractor will hand deliver the cabinet’s master keys to the Owner.

Q. Key Control for Additions and Renovations. Key control shall be provided for additions and renovations of 15 classrooms or less by supplying a complete key storage and management system. Five factory cut “change” keys will be provided for each lockset. Each key shall be fully indexed, tagged and installed on cabinet hooks before the cabinet is delivered to the building by the Contractor and installed in the building as directed by the Owner. The cabinet shall be a heavy-duty metal wall mounted box with a capacity of 200% over the number of locksets and cabinet/casework keys. The key box is to be mounted in the main office vault by the Contractor only. Provide a 3-way cross index system referencing the permanent room number, key symbol and bitting number set up by key control manufacturer and place keys on markers and hooks in the cabinet as determined by the final key schedule. Provide one red tag for each key and mark as “DO NOT REMOVE.” Attach red tag to one of the five keys and place it first in the essential cabinet. The remaining four keys will then be placed on the white clip tags and placed on the same numbered hook. No plastic tags will be accepted. Provide three copies of the key chart showing hook number, keyset number, and location of the room the key opens, the key bittings and three bitting charts. Two charts are to be a permanent part of the key cabinet. Turn over the other key chart and the three bitting charts to the Owner (telephone 301-952-7834). A set of marked blueprints will also be provided showing door numbers and keysets to be placed in the keybox. Provide the key cabinet from one of the following: Key Control Systems, Inc. or Telkee, Inc. This policy will apply to all keying of small additions and/or renovations.

R. Acceptance of the Building and Permanent Keys. The Contractor shall deliver all remaining contract hardware items to the school no later than ten (10) working days before the General Contractor makes his request to activate the Owner’s security system (No. 11 above). All of the following items must be complete before the security system can be turned on.

1. All doors and hardware items delivered and installed.
2. Key cabinets(s) set up, delivered and installed.
3. All contract keys correctly arranged and filed in cabinet(s).
4. All “Best” keys and cylinders delivered to Owner’s locksmith.

5. All keys, cylinders, tools, equipment and supplies have been delivered to the school and securely stored in the key cabinet(s). In addition to the scheduled door hardware, provide the following items:
    a. 5 “change” keys for each door lockset.
    b. Following number of master key sets, AA, AB, AC, per school to be provided - 10 for Elementary Schools, 20 for Middle Schools and 30 for High Schools (any keys for additional master sub-sets will also be provided as required per Section 2.2 B-2).
    c. 100 extra key blanks.
    d. 3 Factory Bitting Charts.
    e. 3 Key Loan Register books, correctly filled in.
    f. 3 copies of architectural floor plans showing door numbers, permanent room names, room numbers and keyset information.
    g. 3 copies of all service manuals with complete parts catalogs listing part numbers and pictures of all parts for all locks provided. .
    h. All control keys.
    i. 6 copies of a transmittal letter listing the above-items and received by space.
    j. Specified number of key cabinets - See No. 12 above.
6. Replace all construction cores or cylinders with specified permanent cylinders as directed elsewhere.
7. General Contractor shall arrange a meeting at the school with the hardware contractor, Architect and Owner when all of the above items are ready for acceptance by calling the Department of Planning and Architectural Services at (301) 952-6548. Request a final hardware inspection and acceptance meeting.

2.06 PUSH/PULL PLATES:

A. Push Plates: Provide push plates on all interior doors. Push plates shall be stainless steel with 4 beveled edges. Plates shall be 1/8” x 3-1/2" x 15" and be cut for cylinder or thumb turn as needed. Provide products from the following list:
    1. Lindstrom 110
    2. Hiawatha, Inc. 200D
    3. Rockwood 70
    4. Trimco 1807-4

B. Pull Plates: Where identified on the hardware schedule, provide pull plates on exterior side of exterior doors. Pull plates shall be stainless steel with four beveled edges, be 1/8” x 3-1/2" x 15" and cut for cylinder as needed. Provide products from the following list:

    Exterior Doors:

    1. Lindstrom 110VA
    2. Hiawatha 1456
    3. Rockwood 91
    4. Trimco 1820

    Interior door pulls will be as described in lockset and exit device specifications listed in Sections 2.2 and 2.4.

2.07 EXIT DEVICES:

A. All code approved exit devices are to be grade one touch-bar type and made of stainless steel construction. Devices shall have rim actuated, single point latching, that is preferred at all locations. Vertical rod, two-point latching, is not preferred for maintenance reasons and shall be avoided wherever possible, Provide pull plates on the exterior side (see 2.3B).

1. Provide products from the following approved list of manufacturers:

Exterior Doors

Von Duprin 98

Sargent 80 Series

Corbin Russwin ED 5000s

Interior Doors

Von Duprin 994L-17

Sargent 80 Series

Corbin Russwin PR 955

B. Classroom Trim. Provide exit device hardware on classroom exterior doors.

C. Attachments: All devices are to be supplied and installed with sleeve nuts and machine bolts. Devices are to be through-bolted to the escutcheon trim for added strength and security.

D. Finish: All devices and trim shall be 32D, Satin Stainless Steel - or Architect approved manufacturer's standard "mostly stainless steel product" listed above.

E. Strike: Provide manufacturer's standard curved face strike or as detailed in the hardware sets. All strike plates must have curved face. Provide metal keeper boxes behind all striker plates.

F. Removable Mullions: Provide Hex Key operated removable mullions at all double doors. Provide weather-stripping on all exterior doors mullions. All mullions to be steel only. Aluminum will not be accepted. Use UL rated mullions where required. All mullions to be furnished with mullion stabilizers. Provide products from the following list:

Sargent 12-L980

Von Duprin #KR9954

Corbin/Russwin #KRM 710

G. Latching Devices:

1. Provide single point latching on interior and exterior single doors and double doors with removable mullions, wherever possible and allowed by code.

2. Provide two point latching with surface-mounted vertical rods on pairs of interior doors, only, where removable mullions are not permitted by code or conditions warrant. Do not provide vertical rod latching on any exterior door assembly.

3. Where vertical rods are warranted, provide vertical rod and latch guard protection over all (above and below) surface-mounted vertical rods. Guards to cover full height of all exposed rods and latching devices. See 2.10 E for approved list.

H. Coordinators: Avoid the use of automatic coordinating device for sequential closing of paired doors to prevent active leaf from closing ahead of inactive leaf. Where automatic flush bolts or self-latching flush bolts must be installed, use one of the following:

Approved List

600 Series

H. B. Ives 900 Series

Glynn-Johnson COR Series

I. Intumescent meeting styles protection is approved where conditions exclude the installation of the above-specified hardware.

Approved List

Zero #328FSA

#328FSD

J. Dust Proof Strikes: Provide dust proof strikes with each bottom surface bolt.

Rockwood 572

2.08 SURFACE BOLTS

As codes and conditions permit, provide surface bolts on the inactive door of pairs at top and bottom of the doors. Provide all necessary strikes, shims and guides to insure proper installation. All bolts shall be zinc-plated or dull chrome finish. Provide surface bolts on top section of dutch doors. Do not use automatic or self-latching flush bolts and do not use mortised type extension flush bolts. Use only surface applied bolts.

Approved List

DCI #780F

H. B. Ives #458

Glynn Johnson Corp., #FB6

Lindstrom Corp. #265

Rockwood #580

2.09 SURFACE CLOSERS:

Provide closers on all interior and exterior doors except on connecting rooms within administration suits.

1. All surface closers shall meet grade 1 or the highest level of cycle test requirements of the applicable ANSI standards. Closers shall be fully hydraulic, rack and pinion action, be constructed of hardened, high-strength cast aluminum or cast iron shell. Cylinders shall be one piece forged steel piston with a minimum diameter of 1 1/16”. Hydraulic fluid shall be non-gumming, non-freezing and not necessitate seasonal adjustments for temperatures from 120° F to -30° F. Provide hydraulic regulation controlled by temper-proof, non-critical screw valves, adjustable with a hex wrench to independently regulate backcheck cushioning and backcheck positions. Provide multi-size spring power adjustment to permit setting of power from 2 - 6. Include high efficiency, low friction pinion bearings. Closers to have delayed action and be designed to resist vandalism and tampering. Closers to be a combination closer/shock absorber stop.
2. Provide heavy-duty, non-adjustable arms with built-in heavy-duty spring to smoothly decelerate door to a stop. Provide the manufacturer’s heaviest/high security arm.
3. All closers are to be supplied and installed with sleeve nuts, Torx screws and machine bolts. Through bolt and use Torx fasteners with center pins at all exposed connections.
4. Provide heavy-duty gauge full metal covers with a minimum of 2 Torx mounting screws. Covers to have closed tops and bottoms. All closer adjustments shall be shielded by the cover. Provide a powder coat painted aluminum finish.

5. Options: As dictated by codes or indicated in the drawings or hardware sets, provide arm and feature options such as adjustable delayed action, barrier free, positive stop and/or hold open arms, low profile arms, and special mounting brackets and plates. Furnish barrier free closers on all interior doors that are not UL listed.
6. All closers and accessories shall be the top of the line and carry a manufacturer's ten- year warranty against workmanship and materials.
7. Provide hold-open models on closers for all exterior doors.
8. Provide support plates for all doors to protect the wood veneer from being crushed by the through door closer fasteners. Locate the plates so one plate supports all of the surface closer fasteners. The plates shall be 1" larger in all directions than the layout of the fastener pattern and made from .050 thick stainless steel, holes to be shop-drilled and countersunk.

Provide closers from the following list:

SARGENT: 350 - MC / 351 - MC SERIES

SARGENT: 9 - 2477 x 24VDC

NORTON: UNI 7500M - AL

NORTON: UNI 7500MBF - AL

L.C.N.: 4040 - 3077SC or 3049SC

L.C.N.: 4041 - 3077SC or 3049SC

Corbin Russwin: DC2200 x A11 (or A12)

2.10 FLOOR CLOSERS AND PIVOTS

A. Provide floor closers and pivots on doors only as required by the architect in hardware schedule.

B. Floor closers shall be cast iron with a spring power adjustable helical spring which rotates and does not move from side to side. Closers shall have separate and independent valves for adjusting closing speed, latch speed, backcheck, hold-open, and delayed action features.

C. Floor closers shall have permanent, non-removable spindles to assure security and total door control.

D. Floor closers shall have a built-in dead stop and shall be installed with intermediate pivots to provide complete door control and a top and bottom simultaneous cushion and dead stop. The pivots and stops are to be supplied by the floor closer manufacturer to assure proper templating and door coordination. In addition, stops must prevent wall or door impacts to door hardware or locksets. Coordinate with Section 2.8 if necessary.

E. Provide floor closers with cold weather fluid, sealed closer feature, rust proof cycolac cement case, threshold and other options as indicated in the drawings or hardware sets.

Approved Manufacturer:

1. Rixon PHQ27-S-105 floor closer, Rixon M19-Pivot.

2.11 DOOR STOPS:

A. Floor Stops: Floor stops are to be the primary door stops, every door leaf is to have either a floor, wall or overhead stop and/or a combination of stops that will prevent the locksets, hardware or door(s) from impacting with walls, cabinets or other objects. Install floor stops on floor surface, vertically plumb, below the center of the door lockset.

Furnish from the following list:

Glynn-Johnson #FB 18S

Rockwood #463

Trimco #1209

B. Wall Stops: Supply wall stops only in such situations where a floor stop cannot be installed, one 3” down from the top of the door and one 3” up from the bottom of the door. An overhead stop may be required in addition to any other specified wall hardware. Wall stops (and/or overhead stops) must prevent a lockset, door hardware or exit device from impacting a wall or other hazard. Walls consisting of open frame and drywall must be re-enforced behind wall stops to prevent wall damage. Supply US26D or US32D finish. Furnish from the following list:

Glynn-Johnson #WB 11X

IVES #443

Hiawatha #1320 E

Rockwood #475

Trimco #1296

C. Overhead Stops: Provide heavy-duty surface-mounted (only) overhead stops where required to prevent doors and/or closer covers from being damaged by coming in contact with cabinetry, corners of walls, etc. All stops will have a no hold-open feature, unless specified elsewhere. Stops shall incorporate a heavy-duty channel and slide arm and offset jamb brackets have tempered steel shock absorber springs that provide 5° - 7° compression before coming to a dead stop. There shall be a nylatron slide block and shock block, designed for high traffic, heavy abuse installations on interior and exterior doors. They shall be non-handed, steel channel arm and bracket, surface mounted, single action, stainless steel.

Provide products from the following list:

Rixson: H.D. 9 Series

Glynn-Johnson: 90 Series

Sargent: 590 or 1540 Series - Non-Friction Type

2.12 ELECTROMAGNET HOLDERS:

A. Electromagnet Holders: All fire labeled cross corridor, multipurpose room, auditorium and stair tower doors shall be held open by narrow projection wall mounted electro-magnet door holders, surface closers and ceiling mounted smoke detectors. The wall magnets shall have concealed wiring and through-bolted armature. Magnet holding power shall be 300 pounds and be protected against transients and surges up to 600 volts. Magnets shall be fail-safe with a positive release button to initiate a closing motion when released by a smoke detector or fire alarm. Furnish from the following list:

Rixson 2-FM993 x 2-9734 - AL

B. NOTE: Securely anchor all electrical boxes to walls with heavy-duty toggle bolts capable of providing a horizontal holding power of 500 pounds of pressure. No plastic anchors will be accepted.

1. Special Openings: Where fire labeled cross corridor openings are fully recessed in a wall pocket, furnish from the following list:

C. Pocket Hinges

1. 6 each Rixson #519
2. 6 each McKinney PH3

D. Wall Magnets

1. 2 each Rixson FM993 Series

E. Smoke Detectors

1. 2 each Rixson #9734

F. Floor Closers

1. 2 each Rixson #50 Series
2. By special layout #2790

G. Vertical Rod Fire Exit Devices

1. 2 each Corbin/Russwin ED5400A -M55 x M910 x 630
2. 2 each Sargent 8715-LBR-ETP
3. 2 each Von Duprin 9827F-LBR x 994L-BE x 630
4. 2 each Yale 7110F-LBR x AU628F x 630

2.13 PROTECTIVE PLATES:

A. Kick and Mop Plates: Provide two kick plates on all interior doors 10" by 1" less than door width. Plates shall be .050 stainless steel and beveled on four sides. All plates shall be prepared for and furnished with stainless steel sheet metal screws.

1. Install on both sides of door
2. 10” high
3. 1” LDW (less than door width) at paired openings and 1 ½” LDW at single doors.
4. Mount plates 1/8” from the bottom of the door.

B. Stretcher Plates: All stretcher plates shall be 6" by 1" less than door width. Plates shall be .050 stainless steel and beveled on three sides.

1. Install on push side of door
2. 6” high
3. 1” LDW (less than door width) at paired openings and 1 ½” LDW at single doors.
4. Install at height to best protect doors from cart damage. Consult with Owner to confirm required height.
5. Bevel edges at top, bottom and sides.

C. Armor Plates: Armor plates shall be 30" by 1" less than door width. On labeled doors, the armor plates shall be a maximum of 16" in height. Plates shall be .050 stainless steel and beveled on three sides. Provide for hardware cutouts as needed. Locations where armor plates are required; A.V. storage, loading docks and any doors where carts will be used.

1. Install on push side of door
2. 30” high, 16” high on labeled doors
3. 1” LDW (less than door width) at paired openings and 1 ½” LDW at single doors.
4. Mount plates 1/8” from bottom of door.
5. Provide hardware cutouts as necessary.

D. Lock Guards: Provide lock guards on doors to gymnasiums, multipurpose rooms, food service, art/shop classrooms, exercise rooms, weight lifting rooms, all storage rooms and the three keyed exterior doors.

1. Heavy gauge, satin finished stainless steel.

2. Offset design to permit clearance for lip of lock strike.
3. Through-bolted with concealed fasteners.
4. Do not provide alignment pins that penetrate the hollow metal doorframe.

   Acceptable products for A, B, C and D are:

   a. Ives 180
   b. Ives 8400 Series
   c. Glynn-Johnson LP10 or LP11
   d. Rockwood
   e. Trimco

E. Vertical Rod Covers and Latch Guards: Provide vertical rod covers from .050 stainless steel that completely fills the space between the latch guards and the exit device's lock stile covers. Provide latch guards from .062 stainless steel, 10" high at the top and bottom exit device's latches. Provide products from the following list:

1. Rockwood #BFRC + BFLG
2. Von Duprin #RF-27

F. Edge Guards: Provide edge guards on all wood doors to storage rooms. Provide products from the following list:

1. Rockwood #306B
2. Hiawatha #DES-5C

2.14 THRESHOLDS:

A. Supply thresholds as indicated in the drawings or in the hardware sets. All thresholds shall conform to state and local building and handicap codes. Set all exterior thresholds in a full bed of joint sealant. Thresholds for floor closers shall be supplied by the floor closer manufacturer. Provide products from the following list:

1. National Guard Product No. 896 or No. 950
2. Pemko No. 2005 or No. 2001
3. Reese No. S483 or No. S256
4. Zero No. 566 or No. 565

2.15 WEATHER-STRIPPING, GASKETING AND SILENCERS:

A. All exterior openings shall be provided with tight fitting weather stripping with UL labeled gasketing. Apply gasketing to head, hinge jamb, and lock jamb. For other applications, refer to drawings and hardware sets.

1. Pemko 315 DR
2. N/G 130 NDKB
3. Reese 373 SSD

B. Door Sweeps: Provide tight fitting door sweeps on the outside of all exterior doors, all kitchen doors and as indicated in the drawings and hardware sets. Supply from the following list:

1. National Guard Products E609 DKB
2. Pemko 18100 DP

3. Reese 965 D
4. Zero 96 A

C. Door Bottoms: Provide tight fitting automatic door seal, mounted on the inside bottom of all exterior doors.

1. National Guard Products 320N
2. Pemko 420AS
3. Ultra DB044

D. Astragels:

Weather-stripping Astragels: Provide tight fitting split astragel meeting stile on exterior sides of all exterior doors. Overlap ends of weather-stripping. Provide products from the following list:

Pemko 18041 DP

1. National Guard 600 DKB
2. Reese 967 D
3. Zero 98 D

E. Silencers: Provide silencers for all hollow metal frames, three at each single door and at each pair of doors. Not required to be listed in hardware schedule, but all door frames are required to have specified number of silencers. Provide 30 extra silencers to owner for replacements. Provide products from the following list:

1. Rockwood 608
2. Glenn Johnson GJ64
3. Ives 20

F. Sound Proofing: As approved by architect.

2.16 FASTENERS:

A. Fasteners shall be suitable size, quantity and of the same material and finishes as the hardware being secured. All fasteners exposed to weather shall be corrosion-resisting steel. Use Torx head screws/bolts with center pin when possible.

1. Machine screws and tampin shields shall be furnished for attaching hardware to concrete, stone or masonry.
2. Machine or sheetmetal screws shall be furnished for attaching hardware to metal.
3. Self-tapping screws shall be furnished for attaching kickplates to mineral core doors and continuous hinges to steel frames.
4. Full thread screws shall be furnished for attaching butt hinges to wood core doors.
5. Sleeve nuts and machine bolts (sex bolts) shall be provided for attaching surface type closers or closer arm and interior pull handles to wood doors, all exit devices, and O.H. holders.
6. Use only machine screw expansion shields when fastening into masonry. Do not use plastic anchors.
7. Use six-lobe Torx security screws with center pin at all exposed connections in all locksets.

PART 3 - EXECUTION

3.01 PRODUCT HANDLING

A. Contractor shall provide adequate locked storage space with shelving and be responsible for scheduled quantities of hardware when delivered to the job, and payment of invoices covering such material, when and as delivered.

B. Tag each item or package separately, with identification related to hardware set number and door number.

C. Inventory hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.

D. Deliver individually packaged and properly tagged finish hardware at the proper time and location to avoid any delays in construction or installation.

E. Control handling and installation of hardware items which are not immediately replaceable, so that completion of the work will not be delayed by hardware losses, both before and after installation.

3.02 HARDWARE INSTALLATION:

A. General: Prior to installing any hardware or locksets, the architect shall arrange a meeting with the general contractor, the hardware/door/frame supplier, the owner, the lockset manufacturer's representatives and the hardware installer to review installers' qualifications, installation, any special

requirements, etc. Installer must have five years minimum comparable experience in commercial/institutional hardware installations. Contractor must provide an ASSA certified locksmith to install ASSA cylinders and inspect for proper function of locksets. Install each hardware item in compliance with manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, install each item completely and then remove and store in a secure place during the finish application. After completion of the finishes, reinstall each item. Do not install surface mounted items until finishes and painting have been completed. Protect hardware from damage until Final Acceptance.

B. Hardware mounting heights shall comply with DHI or MAMNI "Recommended Locations for Builders Hardware" or as scheduled. If no locations are indicated on the drawings, the following location can be used to install the hardware. The contractor is fully responsible for coordinating the entire installation.

Center of Door Lever: 38" above finished floor, A.F.F. (36" elementary schools)

Center of Cylinder Deadlocks: 48" above finished floor

Center of Panic Bars: 36" A.F.F.

Center of Push Plates: 45" A.F.F. (35" elementary schools)

Upper Edge of Top Hinge: 5" below door head

Lower Edge of Bottom Hinge: 10" A.F.F.

Center Hinge: Midway between top and bottom hinge

Floor Stops: Plumb from center of lockset

C. Adjust and check each operating item of hardware and each door to ensure proper operation of functions of every unit. Lubricate moving parts with type lubrication recommended by manufacturer (graphite-type if no other is recommended). Replace units which cannot be adjusted, per manufacturer's instructions and lubricate to operate freely and smoothly as intended for the application made. Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

D. Thresholds shall be full width of openings, notch at stops and center mullions, etc., as required, and set in full bed or butyl rubber or polyisobutylene mastic sealant or in accordance with manufacturer's

instructions such as to prevent seepage of water or vapor.

E. Installation by Other Trades: All electrical equipment is to be coordinated with responsible trade, with proper wire and wiring furnished and connections made under that section per NFPA & NEC.

F. Final Adjustment: Wherever hardware installation is made more than two weeks prior to final acceptance of the building for occupancy, the contractor and hardware installer shall make a final check and adjustment of all hardware items. Clean and relubricate operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment. Replace all defective damaged, missing or stolen hardware.

G. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

H. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

I. Clean adjacent surfaces soiled by hardware installation.

3.03 MATERIALS AND WORKMANSHIP:

A. Provide all hardware, unless otherwise specified, of the best grade, entirely free of imperfections in manufacturer and finish and guaranteed by the manufacturer to satisfactorily perform the various functions required of it for a long life under normal usage but for a period not less than five years from the date of acceptance. Metal finishes will be as specified.

B. Defective Work:

Hardware found defective in materials, fabrication, coordination or installation upon acceptance of the building will be replaced, reworked or otherwise made good as required to the Owner’s specifications at the contractors expense. All replacements and repairs to be completed before the six month inspection as in item (3.3.C) below.

The following shall also be considered as defective or unacceptable materials (But not limited to):

1. Unauthorized substitutes.
2. Items delivered with missing, broken, damaged or defective parts.
3. Items of incorrect hand or function.
4. Improper installation.

C. Six-Month Reinspection: Approximately six months after the final acceptance of the building, the Contractor and the qualified ASSA certified locksmith representatives from the installer shall return to the project to test, adjust, tighten and/or replace all hardware items required to ensure the proper function and to

determine that all hardware punch-list items have been corrected. The Contractor shall replace all items that have failed due to faulty manufacturing, faulty design, poor quality materials and/or improper installation or coordination at no cost to the Owner. After the Contractor is completely satisfied that all hardware items are installed and functioning as intended for its application, he/she shall arrange a meeting with the Owner, ASSA technical personnel, the architect, the installer, the supplier and the lockset manufacturer. A walk-through of the building shall be made to ensure that all hardware items have been installed and functioning correctly.

3.04 PART 4 - HARDWARE SCHEDULE

A. Provide one complete hardware set with appurtenances for each opening, as indicated on the door and frame schedule, and the hardware schedule. All product selections shall only be made from the contract documents without exception.

B. HARDWARE SCHEDULE: PREPARE HARDWARE SET FOR EACH TYPE OF PROJECT APPLICATION

HARDWARE SET NO. 1 SAMPLE

CLASSROOM DOOR FROM CORRIDOR

EACH LIKE DOOR TO HAVE:

FULL MORTISE HINGES 4 1/2X4 1/2X.097 2.1

PRIMARY LOCKSETS-CLASSROOM FUNCTION 2.2

SURFACE CLOSER

WALL/FLOOR STOPS 2.8

KICK PLATES 2.10

SILENCERS 2.12

3.05 LIMITATION OF HARDWARE SCHEDULE:

Schedule is furnished for whatever assistance it may afford the contractor; do not consider it as entirely inclusive. Examine drawings, specifications; determine extent, hardware, quality required. Should any particular door or items be omitted in any schedule hardware group, provide such door or item with hardware, same as required for similar purposes. The contractor is responsible for complying with all regulatory requirements, management of the means, methods, sequencing, coordination and providing complete assemblies for all hardware items.

END OF SECTION 08710

SECTION 08 8000
GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulating glass units.

B. Glazing units.

C. Plastic sheet glazing units.

D. Plastic films.

E. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 4100 - Architectural Wood Casework: Cabinets with requirements for glass shelves.

B. Section 07 2500 - Weather Barriers.

C. Section 07 9200 - Joint Sealants: Sealants for other than glazing purposes.

D. Section 08 1113 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.

E. Section 08 1433 - Stile and Rail Wood Doors: Glazed lites in doors.

F. Section 08 3200 - Sliding Glass Doors: Glazing furnished by door manufacturer.

G. Section 08 3613 - Sectional Doors: Glazed lites in doors.

H. Section 08 4126 - All-Glass Entrances and Storefronts: Glazing furnished as part of entrance assembly.

I. Section 08 4313 - Aluminum-Framed Storefronts: Glazing furnished as part of storefront assembly.

J. Section 08 4413 - Glazed Aluminum Curtain Walls: Glazing furnished as part of wall assembly.

K. Section 08 4500 - Translucent Wall and Roof Assemblies.

L. Section 08 5113 - Aluminum Windows: Glazing furnished by window manufacturer.

M. Section 08 5200 - Wood Windows: Glazing furnished by window manufacturer.

N. Section 08 5313 - Vinyl Windows: Glazing furnished by window manufacturer.

O. Section 08 8300 - Mirrors.

P. Section 10 2800 - Toilet, Bath, and Laundry Accessories: Mirrors.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials current edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test 2015.

C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.

D. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers 2005 (Reapproved 2015).

E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.

F. ASTM C1036 - Standard Specification for Flat Glass 2016.

G. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.

H. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass 2014.

I. GANA (GM) - GANA Glazing Manual 2008.

J. GANA (SM) - GANA Sealant Manual 2008.

K. GANA (LGRM) - Laminated Glazing Reference Manual 2009.

L. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use 1990 (2016).

M. NFRC 100 - Procedure for Determining Fenestration Product U-factors 2017.

N. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence 2014, with Errata (2017).

O. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems 2017.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data on Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Samples: Submit two samples of glass units.

E. Samples: Submit long bead of glazing sealant, color as selected.

F. Certificate: Certify that products of this section meet or exceed specified requirements.

G. Manufacturer's Qualification Statement.

H. Installer's Qualification Statement.

I. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

2. Extra Insulating Glass Units: One of each glass size and each glass type.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with for glazing installation methods. Maintain one copy on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

D. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.06 MOCK-UPS

A. See Section 01 4000 - Quality Requirements, for additional mock-up requirements.

B. Provide mock-up of framing assembly including glass and air barrier and vapor retarder seal.

C. Provide on-site glazing mock-up with the specified glazing components.

D. Locate where directed.

E. Mock-ups may remain as part of the Work.

1.07 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than .

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Insulating Glass Units: Provide a three year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

C. Laminated Glass: Provide a three year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Glass Fabricators:

1. GGI - General Glass International: www.generalglass.com/#sle.
2. JE Berkowitz, LP: www.jeberkowitz.com/#sle.
3. Standard Bent Glass Corp: www.standardbent.com/#sle.

   Trulite Glass & Aluminum Solutions, LLC: www.trulite.com/#sle.
4. Viracon, Inc: www.viracon.com/#sle.
5. Substitutions: Refer to Section 01 6000 - Product Requirements.

B. Float Glass Manufacturers:

1. AGC Glass North America, Inc: www.agcglass.com/#sle.
2. Cardinal Glass Industries: www.cardinalcorp.com/#sle.
3. Guardian Glass, LLC: www.guardianglass.com/#sle.
4. Pilkington North America Inc: www.pilkington.com/na/#sle.
5. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.

C. Laminated Glass Manufacturers:

1. Cardinal Glass Industries: www.cardinalcorp.com/#sle.
2. Viracon, Architectural Glass segment of Apogee Enterprises, Inc: www.viracon.com/#sle.
3. Substitutions: Refer to Section 01 6000 - Product Requirements.

D. Anti-Reflective Glass Manufacturers:

1. GGI - General Glass International; GroGlass: www.generalglass.com/#sle.
2. GlasTroesch Holding AG; LUXAR Anti-Reflective Glass: www.mcgrory.com/#sle.
3. Pilkington North America Inc; Pilkington OptiView Anti-Reflective Glass: www.pilkington.com/na/#sle.
4. SCHOTT North America Inc; Amiran: www.us.schott.com/#sle.

5. Substitutions: Refer to Section 01 6000 - Product Requirements.

E. Fire-Resistance-Rated Glass: Provide products as required to achieve indicated fire-rating period.

F. Fire-Protection-Rated Glass: Provide products as required to achieve indicated fire-rating period.

1. Fabricators:
2. Manufacturers:
3. SCHOTT North America Inc; PYRAN Platinum 20: www.us.schott.com/#sle.
4. Vetrotech North America; Contraflam 45: www.vetrotechusa.com/#sle.
5. Substitutions: Refer to Section 01 6000 - Product Requirements.

G. Patterned Glass Manufacturers:

1. GGI - General Glass International; Patterned Glass: www.generalglass.com/#sle.
2. Oldcastle Building Envelope: www.obe.com/#sle.
3. Substitutions: Refer to Section 01 6000 - Product Requirements.

H. Etched Glass Manufacturers:

1. AGC Glass North America, Inc; Matelux: www.agcglass.com/#sle.
2. GGI - General Glass International; Satin Etched: www.generalglass.com/#sle.
3. Substitutions: Refer to Section 01 6000 - Product Requirements.

I. Wired Glass Manufacturers:

1. GGI - General Glass International; Wire Glass: www.generalglass.com/#sle.

J. Mirrored Glass Manufacturers:

1. Pilkington North America Inc; Pilkington Mirropane Transparent Mirror: www.pilkington.com/na/#sle.
2. Substitutions: Refer to Section 01 6000 - Product Requirements.

K. Plastic Films Manufacturers:

1. 3M Window Film: solutions.3m.com/wps/portal/3M/en_US/Window_Film/Solutions/#sle.
2. Flexvue Films: www.flexvuefilms.com/#sle.
3. Llumar, an Eastman Chemical Company; Llumar or Vista: www.llumar.com/#sle.

L. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

B. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.

1. Design Pressure: Calculated in accordance with ASCE 7.
2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
3. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites

C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II

D. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.

1. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.

2. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.

3. Glass thicknesses listed are minimum.

E. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier.

1. In conjunction with vapor retarder and joint sealer materials described in other sections.

F. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:

1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.

2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.

3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.

1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.

2. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.

3. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.

4. Impact Resistant Safety Glass: Complies with ANSI Z97.1 - Class B, or 16 CFR 1201 - Category I criteria.

5. Tinted Type: ASTM C1036, Class 2 - Tinted, Quality - Q3, with color and performance characteristics as indicated.

6. Patterned Glass Type: ASTM C1036, Type II - Patterned Flat Glass, Quality - Q5, Form 3 - Patterned glass, with color and performance characteristics as indicated.

7. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.

1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.

2.04 INSULATING GLASS UNITS

A. Insulating Glass Units: Types as indicated.

1. Durability: Certified by an independent testing agency to comply with ASTM E2190.

2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
3. Metal Edge Spacers: Aluminum, bent and soldered corners.
4. Spacer Color: Black.
5. Edge Seal:
    a. Single-Sealed System: Provide silicone, polysulfide or polyurethane sealant as seal applied around perimeter.
6. Color: Black.
7. Purge interpane space with dry air, hermetically sealed.
8. Capillary Tubes: Provide tubes from air space for insulating glass units without inert type gas that have a change of altitude greater than 2500 feet (762 m) between point of fabrication and point of installation to permit pressure equalization of air space.
    a. Capillary Tubes: Tubes to remain open and be of length and material type in accordance with insulating glass fabricator's requirements.

B. Type IG-1 - Insulating Glass Units: Vision glass, double glazed.
1. Applications: Exterior glazing unless otherwise indicated.
2. Space between lites filled with air.
3. Outboard Lite: Annealed float glass, 1/4 inch (6.4 mm) thick, minimum.
    a. Tint: Clear.
4. Inboard Lite: Annealed float glass, 1/4 inch (6.4 mm) thick, minimum.
    a. Tint: Clear.
5. Total Thickness: 1 inch (25.4 mm).

C. Type IG-2 - Insulating Glass Units: Vision glass, triple glazed.
1. Applications: Exterior glazing as indicated on drawings.
2. Space between lites filled with air.
3. Outboard Lite: Annealed float glass, 1/4 inch (6.4 mm) thick, minimum.
    a. Tint: Bronze.
4. Middle Lite: Heat-strengthened float glass, 1/4 inch (6.4 mm) thick, minimum.
5. Inboard Lite: Heat-strengthened float glass, 1/4 inch (6.4 mm) thick, minimum.
    a. Tint: Clear.
6. Total Thickness: 1 inch (25.4 mm).

D. Type IG-5 - Insulating Glass Units: Safety glazing.
1. Applications:
    a. Other locations required by applicable federal, state, and local codes and regulations.
2. Space between lites filled with air.
3. Glass Type: Same as except use fully tempered float glass for both outboard and inboard lites.
4. Total Thickness: 1 inch (25.4 mm).

5. Thermal Transmittance (U-Value), Summer - Center of Glass: , nominal.

2.05 BASIS OF DESIGN - INSULATING GLASS UNITS

A. Basis of Design - Insulating Glass Units: Vision glazing, with Low-E coating.

1. Applications: Exterior insulating glass glazing unless otherwise indicated.
2. Space between lites filled with air.
3. Total Thickness: 1 inch (25.4 mm).
4. Thermal Transmittance (U-Value), Summer - Center of Glass: , nominal.
5. Spacer Color: Black.
6. Edge Seal:
7. Color: Black.
8. Purge interpane space with dry air, hermetically sealed.

2.06 GLAZING UNITS

A. Type G-1 - Monolithic Exterior Vision Glazing:

1. Applications: Exterior glazing unless otherwise indicated.
2. Glass Type: Annealed float glass.
3. Tint: Clear.
4. Thickness: 1/4 inch (6.4 mm), nominal.
5. Glazing Method: Dry glazing method, gasket glazing.

B. Type G-2 - Monolithic Interior Vision Glazing:

1. Applications: Interior glazing unless otherwise indicated.
2. Glass Type: Annealed float glass.
3. Tint: Clear.
4. Thickness: 1/4 inch (6.4 mm), nominal.
5. Glazing Method: Dry glazing method, gasket glazing.

C. Type G-3 - Fire-Resistance-Rated Glazing: Type, thickness, and configuration of glazing that contains flame, smoke, and blocks radiant heat, as required to achieve indicated fire-rating period exceeding 45 minutes.

1. Applications:
2. Glass Type: Multi-laminate annealed glass with intumescent fire retardant interlayers.
3. Provide products listed by ITS (DIR) or UL (DIR) and approved by authorities having jurisdiction.
4. Safety Glazing Certification: 16 CFR 1201 Category II.
5. Fire-Rating Period: 60 minutes.

2.07 PLASTIC FILMS

A. Type F-1 - Solar Control Plastic Film: Mylar type.

1. Application: Locations as indicated on drawings.
2. Color: Blue.
3. Thickness Without Liner: 0.00236 inch (0.06 mm).

B. Type F-2 - Safety and Security Plastic Film: Polyester type.

1. Application: Locations as indicated on drawings.
2. Color: Clear.
3. Thickness Without Liner: 0.002 inch (0.051 mm).

2.08 GLAZING COMPOUNDS

A. Type GC-1 - Glazing Putty: Polymer modified latex recommended by manufacturer for outdoor use, knife grade consistency; gray color.

B. Type GC-2 - Butyl Sealant: Single component; ASTM C920 Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.

C. Type GC-3 - Polysulfide Sealant: Two component; chemical curing, non-sagging type; ASTM C920 Type M, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

D. Type GC-5 - Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; [_____] color.

2.09 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) by width of glazing rabbet space minus 1/16 inch (1.5 mm) by height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch (75 mm) long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.

C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.

D. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

E. Glazing Clips: Manufacturer's standard type.

2.10 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing for glass.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that the minimum required face and edge clearances are being provided.

C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

D. Verify that sealing between joints of glass framing members has been completed effectively.

E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.

D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.

E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 INSTALLATION - DRY GLAZING METHOD (TAPE AND GASKET SPLINE GLAZING)

A. Application - Exterior Glazed: Set glazing infills from the exterior of the building.

B. Cut glazing tape to length; install on glazing pane. Seal corners by butting tape and sealing junctions with butyl sealant.

C. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.

D. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.

E. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.

F. Carefully trim protruding tape with knife.

3.06 INSTALLATION - DRY GLAZING METHOD (TAPE AND TAPE)

A. Application - Interior Glazed: Set glazing infills from the interior of the building.

B. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch (1.6 mm) above sight line.

C. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.

D. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.

E. Place glazing tape on free perimeter of glazing in same manner described above.

F. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

G. Carefully trim protruding tape with knife.

3.07 INSTALLATION - WET GLAZING METHOD (COMPOUND AND COMPOUND)

A. Application - Interior Glazed: Set glazing infills from the interior of the building.

B. Install glazing resting on setting blocks. Install applied stop and center pane by use of spacer shims at 24 inch (610 mm) centers, kept 1/4 inch (6 mm) below sight line.

C. Locate and secure glazing pane using glazers' clips.

D. Fill gaps between glazing and stops with glazing compound until flush with sight line. Tool surface to straight line.

3.08 INSTALLATION - WET/DRY GLAZING METHOD (PREFORMED TAPE AND SEALANT)

A. Application - Exterior Glazed: Set glazing infills from the exterior of the building.

B. Cut glazing tape to length and set against permanent stops, 3/16 inch (5 mm) below sight line. Seal corners by butting tape and dabbing with butyl sealant.

C. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.

D. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.

E. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to attain full contact at perimeter of pane or glass unit.

F. Install removable stops, with spacer strips inserted between glazing and applied stops 1/4 inch (6.4 mm) below sight lines.

1. Place glazing tape on glazing pane of unit with tape flush with sight line.

G. Fill gap between glazing and stop with sealant to depth equal to bite of frame on glazing, but not more than 3/8 inch (9 mm) below sight line.

H. Apply cap bead of sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.09 INSTALLATION - STRUCTURAL SILICONE GLAZING

A. Application - Factory (Shop) Glazed: Follow basic guidelines of structural silicone glazing for glazing application.

B. Provide design review of the glazing system and project details, adhesion testing, proper surface preparation, training and a quality service program.

C. Provide only structural silicone sealant, tested and manufactured for structural glazing.

3.10 INSTALLATION - PLASTIC FILM

A. Install plastic film with adhesive, applied in accordance with film manufacturer's instructions.

B. Place without air bubbles, creases or visible distortion.

C. Install film tight to perimeter of glass and carefully trim film with razor sharp knife. Provide 1/16 inch (1.6 mm) to 1/8 inch (3.2 mm) gap at perimeter of glazed panel unless otherwise required. Do not score the glass.

3.11 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

C. Monitor and report installation procedures and unacceptable conditions.

3.12 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove non-permanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.13 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

SECTION 08 8300
MIRRORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glass mirrors.

1. Annealed float glass.

1.02 RELATED REQUIREMENTS

A. Section 06 2000 - Finish Carpentry: Wood mirror frames.

B. Section 10 2800 - Toilet, Bath, and Laundry Accessories: Metal mirror frames.

1.03 REFERENCE STANDARDS

A. ASTM C1036 - Standard Specification for Flat Glass 2016.

B. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.

C. GANA (GM) - GANA Glazing Manual 2008.

D. GANA (SM) - GANA Sealant Manual 2008.

E. GANA (TIPS) - Mirrors: Handle with Extreme Care (Tips for the Professional on the Care and Handling of Mirrors) 2011.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data on Mirror Types: Submit structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Manufacturer's Certificate: Certify that mirrors, meets or exceeds specified requirements.

D. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner 's name and registered with manufacturer.

E. Maintenance Materials: Furnish the following for Owner 's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with for glazing installation methods.

B. Fabricate, store, transport, receive, install, and clean mirrors in accordance with recommendations of GANA (TIPS).

1.06 FIELD CONDITIONS

A. Do not install mirrors when ambient temperature is less than 50 degrees F (10 degrees C).

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for reflective coating on mirrors and replacement of same.

PART 2 PRODUCTS

2.01 MATERIALS

A. Mirror Design Criteria: Select materials and/or provide supports as required to limit mirror material deflection to 1/200, or to the flexure limit of glass, with full recovery of glazing materials, whichever is less.

B. Mirror Glass: Clear, annealed float glass; ASTM C1036, with copper and silver coatings, and protective overcoating.

1. Thickness: 1/4 inch (6.4 mm).
2. Edges: Arrised.
3. Size: As noted on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings for mirrored glazing are correctly sized and within tolerance.

B. Verify that surfaces of mirror frames or recesses are clean, free of obstructions, and ready for installation of mirrors.

3.02 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous mirror frames or recesses with substrate compatible primer or sealer. Prime surfaces scheduled to receive sealant.

C. Prepare installation in accordance with ASTM C1193 for solvent release sealants, and install sealant in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. Install mirrors in accordance with GANA (TIPS) and manufacturers recommendations.

B. Set mirrors plumb and level, and free of optical distortion.

C. Set mirrors with edge clearance free of surrounding construction including countertops or backsplashes.

D. Frameless Mirrors: Set mirrors in proper place with adhesive, applied in accordance with adhesive manufacturer's instructions.

3.04 CLEANING

A. Remove wet glazing materials from finish surfaces.

B. Remove labels after work is complete.

C. Clean mirrors and adjacent surfaces.

D. Do not permit edges of mirrors to be exposed to standing water.

E. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.

F. Wash exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash mirrors as recommended in writing by mirror manufacturer.

END OF SECTION

SECTION 08 8700
SECURITY GLAZING FILMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provision of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

1.03 SECTION INCLUDES:

A. Security Glazing film applied to existing glazing assemblies.

1.04 CODES AND REFERENCES:

A. WEY-SA-C1 – Standard for shooter/attack certification and forced entry.

B. GSA Level C – General Services Administration Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings.

C. ASTM F1642 – Standard Test Method for Glazing and Glazing Systems Subject to Air blast Loadings.

D. UL972 – Standard for Burglary Resisting Glazing.

E. EN356 P4 – Testing and Classification of Resistance Against Manual Attack.

F. ASTM E330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

G. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Consumer Products Safety Commission; current edition.

H. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.

I. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials; 2013a.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Glazing film manufacturer specializing in manufacture of security glazing films with minimum 10 years successful experience.

B. SUBMITTALS

C. Submit under provisions of Division 1.

D. Test Reports: Detailed reports of full-scale chamber tests to specified criteria, using assemblies identical to those required for this project.

E. Product Data: Manufacturer's data sheets on each product to be used, including:

F. Record of product certification for safety requirements.

G. Preparation instructions and recommendations.

H. Storage and handling requirements and recommendations.

1.06 INSTALLATION METHODS.

A. Samples: For each film product to be used, minimum size 4 inches by 6 inches, representing actual product, color, and patterns.

B. Specimen warranty.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufactures unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent—based materials, in accordance with requirements of authorities having jurisdiction.

1.08 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.09 WARRANTY

A. Provide 15 Year manufacturers replacement warranty to cover film against peeling, cracking, discoloration, and deterioration.

PART 2 PRODUCTS

2.01 MANUFACTURER'S

A. Acceptable Manufacturer: Armoured One, LLC., Which is located at: 386 North Midler Ave. Syracuse, NY 13206. Tel: 315-720-4186; Email:info@armouredone.com; Web: www.armouredone.com.

B. Substitutions: Not Permitted

C. Requests for substitutions will be considered in accordance with provisions in Division 1.

D. MATERIALS

E. Security Glazing Film:

F. Transparent polyester film for permanent bonding to glass.

G. Final installed product must be a minimum of 0.023 inches (23 Mil) thick.

H. Installing multiple layers of thinner film to accomplish the required thickness is not allowed.

1. Adhesive Type: Pressure sensitive.
2. Tensile Strength: ASTM D-882, 32,000 psi minimum.
3. Breaking Strength: ASTM D-882, 640 lbs. / inch.
4. Elongation at Break: ASTM D-882, 230%
5. Haze: ASTM D1003, <4%
6. Color b: ASTM D2244, 4.2
7. Visible Light Transmission: 87%
8. Visible Light Reflected (Int): 12%
9. Visible Light Reflected (Ext): 12%
10. UV Block:>99%
11. Total Solar Energy Reflected: 11%
12. Total Solar Energy Transmitted: 77%
13. Total Solar Energy Absorbed: 12%
14. Shading Coefficient: 0.93
15. Total Solar Energy Rejected: 19%
16. Solar Heat Gain Coefficient: 0.81

17. U-Value Winter: 1.03
18. K-Value Winter: 5.85
19. Glare Reduction: 3%

I. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84 (Class A).

J. Retrofit existing glazing assemblies to provide impact resistance and forced/attack resistance complying with WEY-SA-C1, ANSI Z97. I and CPSC 16 CFR 1201 Category II, ASTM E330, UL972, EN356 P4A, and GSA Level C as specified:

K. Provide supplemental anchoring system as required to meet forced entry resistance requirements.

L. Light Transmission of Film Applied on 1/4-inch-Thick Clear Annealed Glass:

M. Visible light Transmittance: 86 percent.

N. Anchoring System: DOW 995 or GE SCS2000 SilPruf Structural Sealant with high impact styrene trim.

PART 3 EXECUTION

3.01 EXAMINATION

A. Field -Applied Film: Verify that existing conditions are adequate for proper application and performance of film.

B. Examine glass and frames, insure that existing conditions are adequate for proper application and

C. Performance of film.

D. Verify glass is not cracked, chipped, broken, or damaged.

E. Verify that frames are securely anchored and free of defects.

3.02 PREPARATION

A. Clean glass of dust, dirt, paint, oil, grease, mildew, mold, and other contaminants that would inhibit adhesion.

B. Immediately prior to applying film, thoroughly wash glass with neutral cleaning solution.

C. Protect adjacent surfaces.

D. Do not begin installation until substrates have been properly prepared.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, without air bubbles, wrinkles, streaks, bands, thin spots, pinholes, or gaps, as required to achieve specified performance.

B. Accurately cut film with straight edges to required sizes allowing 1/16-inch to 1/8-inch gap at perimeter of glazed panel unless otherwise required by anchorage method.

C. Seams. Seam film only as required to accommodate material sizes; seam without overlaps.

D. Clean glass prior to film installation with neutral cleaning solution.

E. Peel back release liner and apply film to glass. Using squeegees, push out solution between film and glass.

F. Once film is installed, anchor the edges of the film by applying approved structural sealant and high impact styrene to the edges of the frames and film.

G. Clean glass and excess structural sealants from finished surfaces

H. Remove any labels or protective covers.

3.04 FILM VERIFICATION

A. Awarded contractor will be required to verify that film installed meets the requirements highlighted in this bid. By submitting a bid, you as the contractor understand that three pieces of glass, chosen at random will be removed and film applied will be measured to verify that film installed meets specifications as requested. Film may need to be removed as part of the verification process.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 08 8853
SECURITY GLAZING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

1.02 DRAWINGS AND GENERAL PROVISION OF THE CONTRACT, INCLUDING GENERAL AND SUPPLEMENTARY CONDITIONS AND DIVISION 01 SPECIFICATION SECTIONS, APPLY TO THIS SECTION.

1.03 SUMMARY

A. Section Includes

B. Shooter/Attack Resistant Security Glazing

C. Shooter/Attack Resistant Fire Rated Security Glazing

D. Shooter/Attack Resistant Insulating Security Glazing

1.04 CODES AND REFERENCES:

A. WEY-SA – Standard for shooter/attack certification and Forced Entry

B. GSA Level C – General Services Administration Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings.

C. ASTM F1642 – Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings

D. UL972 – Standard for Burglary Resistant Glazing

E. EN356 P4 – Testing Classification of Resistance Against Manual Attack

F. ASTM E330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

G. 16 CFR 1201 – Safety Standard for Architectural Glazing Materials; Consumer Products Commission; current edition.

H. ANSI Z97.1 – American National Standard for Safety Glazing Materials Used in Building, Safety Performance Specifications and Methods of Test; 2010.

I. NFPA 80 – Fire Doors and Windows.

J. ICC/BC – International Building Code.

K. NFPA 252 Standard Methods of Fire Tests of Door Assemblies.

L. Tested in accordance with Underwriters Laboratory Standard for Positive Pressure Fire Tests of Door Assemblies UL9, UL10B and UL10C.

M. State Building Codes, Local Amendments.

1.05 QUALITY ASSURANCE

A. Manufacturers Qualifications: Provide glazing systems produced by a manufacturer with not less than 5-years successful experience in the fabrication of assemblies of the type and quality required.

B. Installer’s Qualifications: Glazed systems shall be installed by a firm that has not less than 5-years successful experience in the installation of systems like those required.

C. Source Limitations for Glass: Obtain all glass products from a single manufacturer.

D. Glass Product Testing: Obtain glass test results for product test reports in “Submittals” Article from a qualified independent agency.

1.06 SUBMITTALS

A. Submit under provisions of Division 1

B. Product Data: Manufacturers data sheets of each product to be used, including:

C. Preparation instructions and recommendation

D. Storage and handling requirements and recommendations

E. Installation methods.

F. Glazing Schedule:

G. Use same designations indicated on Drawings.

H. Listing types and thicknesses for each size, opening and location.

1.07 SAMPLES:

A. Submit one 12” x 12” sample of each glass type specified

B. Submit one sample of each glazing sealant and/or glazing tape for color review.

1.08 WARRANTY: WARRANTY DOCUMENTS SPECIFIED HEREIN.

1.09 CERTIFICATIONS:

A. Certification that all sealants are fully compatible with the surfaces and finishes with which they are in applied.

B. Certification that all products comply with the test methods listed under Paragraph 1.3 Codes and References.

1.10 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer’s unopened and undamaged packaging, with manufacturer’s labels intact.

B. Protect glass and glazing materials from damage in ordinance with manufacturer’s recommendations.

1.11 WARRANTIES

A. Non-Rated Glass Units: Warrant for 10 years from date of Delivery to be free from delamination and failure of seals and not to develop material obstruction of vision, as a result of dust, moisture or film formation on internal glass surfaces.

B. Low-E Glass: Warrant for 10 years from date of Delivery to be free of peeling or other deterioration of the Low-E coating.

C. Fire Rated Glass: Warrant for 5 years from date of Delivery to be free from delamination and discoloration.

D. Glazing Sealants: Warrant for 10 years per sealant manufacturer's standard warranty of merchantable quality. Warranty shall certify that cured sealants:

E. Will perform as a watertight weather-seal.

F. Will not become brittle or crack due to weathering or normal expansion and contraction of adjacent surfaces.

G. Will not harden beyond a Shore A durometer of 50, nor soften below a durometer of 10.

H. Will not change color when used with compatible back-up materials.

I. Will not bleed.

1.12 PART 2 – PRODUCTS

MANUFACTURER'S

A. Acceptable Manufacturer: Armoured One, LLC., Which is located at: 386 North Midler Ave. Syracuse, NY 13206. Tel: 315-720-4186; Email:info@armouredone.com; Web: www.armouredone.com.

B. Substitutions: Not Permitted

C. Requests for substitutions will be considered in accordance with provisions in Division 1.

MATERIALS

D. Shooter/Attack Resistant Security Glass, Non-Rated: AOTSG516

1. Thickness: 5/16"
2. WEY-SA-C2 – Standard for shooter/attack certification and forced entry Class 2.
3. GSA Level C – General Services Administration Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings.
4. ASTM F1642 – Standard Test Method for Glazing and Glazing Systems Subject to Air blast Loadings.
5. UL972 – Standard for Burglary Resisting Glazing.
6. EN356 P4 – Testing and Classification of Resistance against manual attack.
7. ASTM E330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
8. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Consumer Products Safety Commission; current edition.
9. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.

E. Shooter/Attack Resistant Security Glass, Non-Rated: AOTSG616

1. Thickness: 3/8"
2. WEY-SA-C2 – Standard for shooter/attack certification and forced entry Class 2.
3. GSA Level C – General Services Administration Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings.
4. ASTM F1642 – Standard Test Method for Glazing and Glazing Systems Subject to Air blast Loadings.
5. UL972 – Standard for Burglary Resisting Glazing.
6. EN356 P4 – Testing and Classification of Resistance against manual attack.
7. ASTM E330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
8. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Consumer Products Safety Commission; current edition.
9. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.

F. Shooter/Attack Resistant Security Glass, Non-Rated Insulated: AOTSG1

1. Thickness: 1"
2. WEY-SA-C2 – Standard for shooter/attack certification and forced entry Class 2.

3. GSA Level C – General Services Administration Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings.
4. ASTM F1642 – Standard Test Method for Glazing and Glazing Systems Subject to Air blast Loadings.
5. UL972 – Standard for Burglary Resisting Glazing.
6. EN356 P4 – Testing and Classification of Resistance against manual attack.
7. ASTM E330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
8. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Consumer Products Safety Commission; current edition.
9. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.

G. Shooter/Attack Resistant Security Glass, 20-Minute Rated: AOTSG516FR-20

1. Thickness: 5/16”
2. Tested in accordance with NFPA 80, NFPA 252, UL 9, UL 10B, UL 10C
3. WEY-SA-C2 – Standard for shooter/attack certification and forced entry Class 2.
4. GSA Level C – General Services Administration Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings.
5. ASTM F1642 – Standard Test Method for Glazing and Glazing Systems Subject to Air blast Loadings.
6. UL972 – Standard for Burglary Resisting Glazing.
7. EN356 P4 – Testing and Classification of Resistance against manual attack.
8. ASTM E330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
9. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Consumer Products Safety Commission; current edition.
10. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.

H. Shooter/Attack Resistant Security Glass, 45-Minute Rated: AOTSG1016FR-45

1. Thickness: 5/8”
2. Tested in accordance with NFPA 80, NFPA 252, UL 9, UL 10B, UL 10C
3. WEY-SA-C2 – Standard for shooter/attack certification and forced entry Class 2.
4. GSA Level C – General Services Administration Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings.
5. ASTM F1642 – Standard Test Method for Glazing and Glazing Systems Subject to Air blast Loadings.
6. UL972 – Standard for Burglary Resisting Glazing.
7. EN356 P4 – Testing and Classification of Resistance against manual attack.
8. ASTM E330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

9. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Consumer Products Safety Commission; current edition.
10. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.

I. Shooter/Attack Resistant Security Glass, 60-Minute Rated: AOTSG1616FR-60

1. Thickness: 1”
2. Tested in accordance with NFPA 80, NFPA 252, UL 9, UL 10B, UL 10C
3. WEY-SA-C2 – Standard for shooter/attack certification and forced entry Class 2.
4. GSA Level C – General Services Administration Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings.
5. ASTM F1642 – Standard Test Method for Glazing and Glazing Systems Subject to Air blast Loadings.
6. UL972 – Standard for Burglary Resisting Glazing.
7. EN356 P4 – Testing and Classification of Resistance against manual attack.
8. ASTM E330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
9. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Consumer Products Safety Commission; current edition.
10. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.

J. Shooter/Attack Resistant Security Glass, 90-Minute Rated: AOTSG616FR-90

1. Thickness: 3/8”
2. Tested in accordance with NFPA 80, NFPA 252, UL 9, UL 10B, UL 10C
3. WEY-SA-C2 – Standard for shooter/attack certification and forced entry Class 2.
4. GSA Level C – General Services Administration Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings.
5. ASTM F1642 – Standard Test Method for Glazing and Glazing Systems Subject to Air blast Loadings.
6. UL972 – Standard for Burglary Resisting Glazing.
7. EN356 P4 – Testing and Classification of Resistance against manual attack.
8. ASTM E330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
9. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Consumer Products Safety Commission; current edition.
10. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.

GLAZING MATERIAL

11. General: Provide standard color of glazing materials as selected by Architect. Comply with manufacturer's recommendations for applications and conditions at time of installation.
12. 3M VHB 5952 – 3M (Anchoring tape applied on vision kits to adhere glazing to vision kit.)

13. Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.
14. Setting Blocks: Neoprene, silicone or EPDM, 70-90 durometer hardness, with proven compatibility with glazing materials used.
15. Spacers: Neoprene, silicone or EPDM, 40-50 durometer hardness with proven compatibility with glazing materials used.
16. Compressible Fillers: Closed-cell or waterproof-jacketed rod stock of synthetic rubber or plastic foam, proven to be compatible with sealants used, flexible and resilient, with 5-10 psi compression strength for 25% deflection.

FABRICATION

17. Cut glass to full fit and play, consistent with glass and glazing material manufacturers' recommendations and the requirements of the Drawings and References, Codes and Standards Article.
18. Follow code requirements and glass manufacturer's recommendations for minimum bite and edge and face clearances.
19. Cut lights to smooth straight edges, clean, free of nicks and flares; nipping not permitted. Follow glass manufacturer's directions exactly for tinted and Low-E glass
20. Glass Identification:
    a. Glazing in fire rated doors and fire rated windows shall bear UL classification marking in accordance with UL 9.
    b. Manufacturer's and UL identifications for glazing shall be permanently etched to be visible after glass has been set in place and glazed.

1.13 PART 3 EXECUTION

A. gENERAL

1. Each glazing installation must withstand normal temperature changes, and impact loading without failure of glass, failure of sealants or gaskets, deterioration of glazing materials and other defects in the work.
2. Protect glass from damage during handling and installation, and subsequent operation of glazed components of the work. Discard units with edge damage or other imperfections.
3. Glazing channel dimensions are intended to provide for necessary bite on glass, minimum edge clearance, and adequate tape or sealant thicknesses, with reasonable tolerances.
4. Comply with recommendations by manufacturers of glass and glazing products, except where more stringent requirements are indicated, including those of referenced glazing standards.

B. pREPARATION

1. Clean glazing channel and other framing members to receive glass, immediately before glazing. Remove coatings which are not firmly bonded to substrate.
2. Where sealants are used, apply primer or sealant to joint surfaces where recommended by sealant manufacturer.

C. INSTALLATION

1. Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics.
2. Where sealants are used at butt joints, apply sealant in thin continuous clear bead. Tool sealant to a uniform, continuous, even profile.

3. Apply glazing stops and clean up any excess structural sealants from finished surfaces.
4. Conform to recommendations of glass manufacturer where such covers points not shown on Drawings or specified herein.
5. Remove "loose" stops furnished with the units and reinstall as a part of the glazing operation.
6. Handle glass so as to prevent nicks and flares on glass edges.
7. Install glass exceeding 1/8" thickness on identical setting blocks permanently mounted and centered at 1/4 points. If necessary to reduce deflection of horizontal supporting member, blocks may be placed at 1/8 points or with the nearest end 6" (whichever is greater) from edge of glass unit. Ensure that blocks are equidistant from centerline of glass. Do not obstruct weep holes.
8. Provide permanently mounted edge blocks at head and jambs of dry-glazed lights to prevent damage to glass edges during installation and lateral shifting of glass due to thermal and seismic loads and vibrations. Follow recommendations of Flat Glass Marketing Assn. Glazing Manual.
9. Set glass to maintain bite, edge and face clearance stipulated by code and the glass manufacturer.
10. Take special precautions to protect laminated glass edges from deterioration of vinyl interlayer by moisture.
11. Glaze dry-glazed aluminum doors and frames as per manufacturer's directions using glazing gaskets and seals furnished with the units.
12. Miter gaskets at corners and install so as to prevent pulling away at corners. Gaskets with gaps or other visible irregularities on door and window units shall be corrected by manufacturer or fabricator at no additional cost to University.

1.14 PROTECTION AND CLEANING

A. Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during construction period, including natural causes, accidents and vandalism.

B. Wash and polish glass on both faces not more than 4 days prior to date scheduled for inspections intended to establish Date of Substantial Completion in each area of project. Comply with glass manufacturer's recommendations for final cleaning.

END OF SECTION

SECTION 08 9100
LOUVERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Louvers, frames, and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 2500 - Weather Barriers: Sealing frames to weather barrier installed on adjacent construction.

B. Section 07 6200 - Sheet Metal Flashing and Trim.

C. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.

D. Section 09 9113 - Exterior Painting: Field painting.

E. Section 23 0913 - Instrumentation and Control Devices for HVAC: Actuators for operable louvers.

F. Section 23 0923 - Direct-Digital Control System for HVAC: Actuators for operable louvers.

G. Section 23 3100 - HVAC Ducts and Casings: Ductwork attachment to louvers.

H. Section 23 3300 - Air Duct Accessories: Fire/smoke dampers associated with exterior wall louvers.

I. Section 28 4600 - Fire Detection and Alarm: Smoke control connection.

1.03 REFERENCE STANDARDS

A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating 2015.

B. AMCA 511 - Certified Ratings Program for Air Control Devices 2010.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2017.

D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2014.

F. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2013.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.

C. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, tolerances; head, jamb and sill details; blade configuration, screens, blankout areas required, and frames.

D. Samples: Submit two samples 2 by 2 inches (50 by 50 mm) in size illustrating finish and color of exterior and interior surfaces.

E. Test Reports: Independent agency reports showing compliance with specified performance criteria.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

G. Maintenance Data: Include lubrication schedules, adjustment requirements.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer's warranty against distortion, metal degradation, and connection failures of louver components.

1. Finish: Include twenty year coverage against degradation of exterior finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Louvers:

1. Greenheck; www.greeheck.com
2. Ruskin; www.ruskin.com
3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 LOUVERS

A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511.

1. Wind Load Resistance: Design to resist positive and negative wind load of 25 psf (of 1.2 kPa) without damage or permanent deformation.
2. Intake Louvers: Design to allow maximum of 0.01 oz/sq ft (3.1 g/sq m) water penetration at calculated intake design velocity based on design air flow and actual free area, when tested in accordance with AMCA 500-L.
3. Screens: Provide insect screens at intake louvers and bird screens at exhaust louvers.

B. Stationary Louvers: Horizontal blade, formed galvanized steel sheet construction, with intermediate mullions matching frame.

1. Blades: Straight.
2. Frame: 4 inches deep (100 mm deep), channel profile; corner joints mitered and , with continuous recessed caulking channel each side.
3. Steel Thickness, Galvanized: Frame 16 gage, 0.0598 inch (1.52 mm) minimum base metal; blades 16 gage, 0.0598 inch (1.52 mm) minimum base metal.
4. Steel Finish: Superior performing organic coatings, finished after fabrication.

C. Facade Ventilator Louvers: Thermally broken, with extruded aluminum framework and rubber seals, air or smoke ventilator; awning type window, top hinged.

1. Aluminum Frame: 3 inch (76 mm) deep, 3-7/8 inch (99 mm) wide, extruded aluminum of alloy 6063 and T6 temper.
2. Aluminum Finish: Class II natural anodized; finished after fabrication.
3. Frame Mounting: As indicated on drawings.
4. Frame Size: As indicated on drawings.
5. Glazing In-Fill Panel: Tempered glass, 1/4 inch (6.4 mm) thick.

2.03 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

C. Stainless Steel: ASTM A666, Type 304, soft temper, smooth surface, No. 4 brushed finish.

2.04 ACCESSORIES

A. Blank-Off Panels: Aluminum face and back sheets, polyisocyanurate foam core, 1-1/2 inch (38 mm) thick, coordinate paint color with owner; provide where duct connected to louver is smaller than louver frame, sealing off louver area outside duct.

B. Screens: Frame of same material as louver, with reinforced corners; removable, screw attached; installed on inside face of louver frame.

C. Bird Screen: Interwoven wire mesh of steel, 14 gage, 0.0641 inch (1.63 mm) diameter wire, 1/2 inch (13 mm) open weave, diagonal design.

D. Insect Screen: 18 x 16 size aluminum mesh.

E. Fasteners and Anchors: Galvanized steel.

F. Flashings: Of same material as louver frame, formed to required shape, single length in one piece per location.

G. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared openings and flashings are ready to receive this work and opening dimensions are as indicated on shop drawings.

B. Verify that field measurements are as indicated.

3.02 INSTALLATION

A. Install louver assembly in accordance with manufacturer's instructions.

B. Coordinate with installation of flashings by others.

C. Install louvers level and plumb.

D. Set sill members and sill flashing in continuous bead of sealant.

E. Align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.

F. Secure louver frames in openings with concealed fasteners.

G. Coordinate with installation of mechanical ductwork, if required.

H. Coordinate with installation of louver actuators, if required.

3.03 ADJUSTING

A. Adjust operable louvers for freedom of movement of control mechanism. Lubricate operating joints.

3.04 CLEANING

A. After installation, all exposed prefinished and plated items and all items fabricated from stainless steel and aluminum are to be cleaned as recommended by the manufacturer and protected from damage until completion of the project.

B. All movable parts, including hardware, are to be cleaned and adjusted to operate as designed without binding or deformation of the members, so as to be centered in the opening of frame, and where applicable, to have all contact surfaces fit tight and even without forcing or warping the components.

C. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Contracting Officer Representative (COR) damaged units and replace with new units.

END OF SECTION

SECTION 08 9200
LOUVERED EQUIPMENT ENCLOSURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Louvered aluminum screens for concealing rooftop equipment.

B. Slatted aluminum screens for concealing rooftop equipment.

1.02 RELATED REQUIREMENTS

A. Section 05 5000 - Metal Fabrications: Superstructure support and bracing of rooftop screens and grilles.

B. Section 07 5100 - Built-Up Bituminous Roofing: Treating penetrations for support of rooftop screens.

C. Section 08 9100 - Louvers.

1.03 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2014.

D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2013.

E. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation 2018.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Storage and handling requirements and recommendations.

2. Installation methods.

C. Shop Drawings: Include plans, sections, and details of connections and bracing.

1. Include structural calculations indicating compliance with wind loading requirements.

2. Show field measurements of roof openings on shop drawings.

D. Manufacturer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than ten years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Comply with manufacturer's instructions for handling of grille and screen products.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Submit manufacturer's standard ten-year finish warranty.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Wind Resistance: Design grilles and screens, including superstructure support system, to withstand positive and negative wind loading in accordance with applicable building code.

2.02 LIGHTWEIGHT LOUVERED ALUMINUM SCREEN PANELS

A. Construction: Panels comprising interlocking aluminum box beam frames packed with polystyrene insulation and reinforced as necessary with aluminum I-beams, with fixed horizontal aluminum louvers inserted into vertical frame members.

1. Box Beam Frames and Louvers: Roll-formed aluminum sheet, alloy 3005-H25 temper, or equivalent in accordance with ASTM B209 (ASTM B209M), 0.025 inch (0.635 mm) thick.
2. I-Beam Inserts: Extruded aluminum, alloy 6063-T6 temper, or equivalent in accordance with ASTM B221 (ASTM B221M), 0.052 inch (1.32 mm) typical wall thickness.
3. Insulation: Expanded polystyrene complying with ASTM C578.
4. Fasteners: Self-tapping stainless steel screws or aluminum pop rivets.
5. Accessories and Installation Hardware: High quality stainless steel or other non-corrosive materials.

B. Box Beam Frames: Face width of 2-1/2 inch (63.5 mm) and depth of 1-5/8 inch (41.3 mm).

C. Louver Blades: Roll-formed into beveled-edge design, 1-3/4 inch (44.5 mm) wide, and spaced at 1-1/4 inch (32 mm) on center.

D. Aluminum Finish: Low gloss polyester enamel paint, roller coated over pretreated aluminum and baked at 400 degrees F (204 degrees C).

1. Color: As selected from manufacturer's standard colors.

E. Overall Screen Configuration: Dimensions, details, and layout as indicated on drawings.

2.03 LIGHTWEIGHT PITCHED LOUVERED SCREENS

A. Construction: Individual roll-formed aluminum blades snapped onto reinforced aluminum stringers spaced at 24 inch (610 mm) on center, that are supported by customized support structure.

1. Louver Blades: Alloy 3005-H25 temper, or equivalent in accordance with ASTM B209 (ASTM B209M), 3-3/8 inch (85.7 mm) aluminum slats roll-formed into shallow channel shape and designed to snap onto vertical stringers.

B. Aluminum Finish: Low gloss polyester enamel paint, roller coated over pretreated aluminum and baked at 400 degrees F (204 degrees C).

1. Color: As selected from manufacturer's standard colors. Coordinate final selection with Owner.

C. Overall Screen Configuration: Dimensions, details, and layout as indicated on drawings.

2.04 EXTRUDED HORIZONTAL LOUVERS

A. Construction: Individual extruded aluminum louvers in inverted overlapping configuration, with blade supports attached to and supported by customized support structure.

B. Louver Blades: Alloy 6063-T5 or T6 temper, or equivalent in accordance with ASTM B221 (ASTM B221M), 0.081 inch (2.06 mm) thick, 4 inch (102 mm) deep, spaced at 5 inch (127 mm) on center, and configured to totally block sightlines from grade.

C. Overall Screen Configuration: Dimensions, details, and layout as indicated on drawings.

2.05 LIGHTWEIGHT VERTICAL SLAT SCREENS

A. Construction: Individual roll-formed aluminum slats snapped onto extruded horizontal aluminum stringers spaced at 24 inch (610 mm) on center, that are supported by customized support structure.

B. Overall Screen Configuration: Dimensions, details, and layout as indicated on drawings.

2.06 EXTRUDED VERTICAL SLAT SCREENS

A. Construction: Individual extruded aluminum slats in spaced configuration for partial sight restriction, with aluminum supports that are supported by customized support structure.

B. Slats: Alloy 6063-T5 or T6 temper, or equivalent in accordance with ASTM B221 (ASTM B221M), 0.05 inch (1.3 mm) thick, nominal 3-1/2 inch (89 mm) wide and 5/8 inch (15.9 mm) deep, spaced at nominal 1/2 inch (12.7 mm)

C. Overall Screen Configuration: Dimensions, details, and layout as indicated on drawings.

2.07 ACCESSORIES

A. Miscellaneous Trim: Aluminum sheet, alloy 3005-H25 temper, or equivalent in accordance with ASTM B209 (ASTM B209M), formed to shapes indicated and finished to match other components.

B. Support Structure: As specified in Section 05 5000.

C. Fasteners: Self-tapping stainless steel screws, as approved by manufacturer of rooftop equipment screens.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install rooftop equipment screens in accordance with manufacturer's printed instructions and as indicated on shop drawings.

B. Form tight joints and fit exposed connections accurately.

C. Provide necessary fastenings and anchors required for a complete installation, and install units plumb, level, and in proper alignment with adjacent work.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Protect metal surfaces from corrosion or galvanic action by application of a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry or dissimilar metals.

C. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 08 9200
LOUVERED EQUIPMENT ENCLOSURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Louvered aluminum screens for concealing rooftop equipment.

B. Slatted aluminum screens for concealing rooftop equipment.

1.02 RELATED REQUIREMENTS

A. Section 05 5000 - Metal Fabrications: Superstructure support and bracing of rooftop screens and grilles.

B. Section 07 5100 - Built-Up Bituminous Roofing: Treating penetrations for support of rooftop screens.

C. Section 08 9100 - Louvers.

1.03 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2014.

D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2013.

E. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation 2018.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Storage and handling requirements and recommendations.

2. Installation methods.

C. Shop Drawings: Include plans, sections, and details of connections and bracing.

1. Include structural calculations indicating compliance with wind loading requirements.

2. Show field measurements of roof openings on shop drawings.

D. Manufacturer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than ten years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Comply with manufacturer's instructions for handling of grille and screen products.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Submit manufacturer's standard ten-year finish warranty.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Wind Resistance: Design grilles and screens, including superstructure support system, to withstand positive and negative wind loading in accordance with applicable building code.

2.02 LIGHTWEIGHT LOUVERED ALUMINUM SCREEN PANELS

A. Construction: Panels comprising interlocking aluminum box beam frames packed with polystyrene insulation and reinforced as necessary with aluminum I-beams, with fixed horizontal aluminum louvers inserted into vertical frame members.

1. Box Beam Frames and Louvers: Roll-formed aluminum sheet, alloy 3005-H25 temper, or equivalent in accordance with ASTM B209 (ASTM B209M), 0.025 inch (0.635 mm) thick.
2. I-Beam Inserts: Extruded aluminum, alloy 6063-T6 temper, or equivalent in accordance with ASTM B221 (ASTM B221M), 0.052 inch (1.32 mm) typical wall thickness.
3. Insulation: Expanded polystyrene complying with ASTM C578.
4. Fasteners: Self-tapping stainless steel screws or aluminum pop rivets.
5. Accessories and Installation Hardware: High quality stainless steel or other non-corrosive materials.

B. Box Beam Frames: Face width of 2-1/2 inch (63.5 mm) and depth of 1-5/8 inch (41.3 mm).

C. Louver Blades: Roll-formed into beveled-edge design, 1-3/4 inch (44.5 mm) wide, and spaced at 1-1/4 inch (32 mm) on center.

D. Aluminum Finish: Low gloss polyester enamel paint, roller coated over pretreated aluminum and baked at 400 degrees F (204 degrees C).

1. Color: As selected from manufacturer's standard colors.

E. Overall Screen Configuration: Dimensions, details, and layout as indicated on drawings.

2.03 LIGHTWEIGHT PITCHED LOUVERED SCREENS

A. Construction: Individual roll-formed aluminum blades snapped onto reinforced aluminum stringers spaced at 24 inch (610 mm) on center, that are supported by customized support structure.

1. Louver Blades: Alloy 3005-H25 temper, or equivalent in accordance with ASTM B209 (ASTM B209M), 3-3/8 inch (85.7 mm) aluminum slats roll-formed into shallow channel shape and designed to snap onto vertical stringers.

B. Aluminum Finish: Low gloss polyester enamel paint, roller coated over pretreated aluminum and baked at 400 degrees F (204 degrees C).

1. Color: As selected from manufacturer's standard colors. Coordinate final selection with Owner.

C. Overall Screen Configuration: Dimensions, details, and layout as indicated on drawings.

2.04 EXTRUDED HORIZONTAL LOUVERS

A. Construction: Individual extruded aluminum louvers in inverted overlapping configuration, with blade supports attached to and supported by customized support structure.

B. Louver Blades: Alloy 6063-T5 or T6 temper, or equivalent in accordance with ASTM B221 (ASTM B221M), 0.081 inch (2.06 mm) thick, 4 inch (102 mm) deep, spaced at 5 inch (127 mm) on center, and configured to totally block sightlines from grade.

C. Overall Screen Configuration: Dimensions, details, and layout as indicated on drawings.

2.05 LIGHTWEIGHT VERTICAL SLAT SCREENS

A. Construction: Individual roll-formed aluminum slats snapped onto extruded horizontal aluminum stringers spaced at 24 inch (610 mm) on center, that are supported by customized support structure.

B. Overall Screen Configuration: Dimensions, details, and layout as indicated on drawings.

2.06 EXTRUDED VERTICAL SLAT SCREENS

A. Construction: Individual extruded aluminum slats in spaced configuration for partial sight restriction, with aluminum supports that are supported by customized support structure.

B. Slats: Alloy 6063-T5 or T6 temper, or equivalent in accordance with ASTM B221 (ASTM B221M), 0.05 inch (1.3 mm) thick, nominal 3-1/2 inch (89 mm) wide and 5/8 inch (15.9 mm) deep, spaced at nominal 1/2 inch (12.7 mm)

C. Overall Screen Configuration: Dimensions, details, and layout as indicated on drawings.

2.07 ACCESSORIES

A. Miscellaneous Trim: Aluminum sheet, alloy 3005-H25 temper, or equivalent in accordance with ASTM B209 (ASTM B209M), formed to shapes indicated and finished to match other components.

B. Support Structure: As specified in Section 05 5000.

C. Fasteners: Self-tapping stainless steel screws, as approved by manufacturer of rooftop equipment screens.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install rooftop equipment screens in accordance with manufacturer's printed instructions and as indicated on shop drawings.

B. Form tight joints and fit exposed connections accurately.

C. Provide necessary fastenings and anchors required for a complete installation, and install units plumb, level, and in proper alignment with adjacent work.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Protect metal surfaces from corrosion or galvanic action by application of a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry or dissimilar metals.

C. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 09 0561
COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section applies to floors identified in contract documents that are receiving the following types of floor coverings:
   1. Resilient tile and sheet.
   2. Carpet tile.
   3. Thin-set ceramic tile and stone tile.
   4. Rubber Flooring.
   5. Vinyl Ceramic Tile (VCT).
   6. Terrazzo Flooring

B. Removal of existing floor coverings.

C. Preparation of new concrete floor slabs for installation of floor coverings.

D. Testing of concrete floor slabs for moisture and alkalinity (pH).

E. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
   1. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.

F. Patching compound or Ardex should be used for leveling or sloping floor to meet Owner's requirements

G. Remedial floor coatings.

H. Remedial floor sheet membrane.

I. Preparation of new and existing wood-based floors and subfloors for installation of new floor coverings.

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Additional requirements relating to testing agencies and testing.

B. Section 01 7419 - Construction Waste Management and Disposal: Handling of existing floor coverings removed.

C. Section 03 3000 - Cast-in-Place Concrete: Moisture emission reducing curing and sealing compound for slabs to receive adhered flooring, to prevent moisture content-related flooring failures; to remain in place, not to be removed.

D. Section 03 3000 - Cast-in-Place Concrete: Concrete admixture for slabs to receive adhered flooring, to prevent moisture content-related flooring failures.

E. Section 03 5400 - Cast Underlayment: Self-leveling underlayment applied as remediation treatment.

1.03 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens) 2016a.

B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete 1999 (Reapproved 2014).

C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2017.

D. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes 2017.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.05 SUBMITTALS

A. Visual Observation Report: For existing floor coverings to be removed.

B. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:

1. Moisture and alkalinity (pH) limits and test methods.
2. Manufacturer's required bond/compatibility test procedure.

C. Testing Agency's Report:

1. Description of areas tested; include floor plans and photographs if helpful.
2. Summary of conditions encountered.
3. Moisture and alkalinity (pH) test reports.
4. Copies of specified test methods.
5. Recommendations for remediation of unsatisfactory surfaces.
6. Product data for recommended remedial coating.
7. Include certification of accuracy by authorized official of testing agency.
8. Submit report to Architect.
9. Submit report not more than two business days after conclusion of testing.

1.06 QUALITY ASSURANCE

A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.

B. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.

1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.

C. Contractor's Responsibility Relating to Independent Agency Testing:

1. Provide access for and cooperate with testing agency.
2. Confirm date of start of testing at least 10 days prior to actual start.
3. Allow at least 4 business days on site for testing agency activities.
4. Achieve and maintain specified ambient conditions.
5. Notify Architect when specified ambient conditions have been achieved and when testing will start.

D. Remedial Coating Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing moisture emission coatings.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products in accordance with manufacturer’s instructions and recommendations.

B. Deliver materials in manufacturer’s packaging; include installation instructions.

C. Keep materials from freezing.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F (18 degrees C) or more than 85 degrees F (30 degrees C).

B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS

2.01 MATERIALS

A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:

1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.

2. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.

3. Products:

a. ARDEX Engineered Cements; ARDEX Feather Finish: www.ardexamericas.com/#sle.

B. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.

C. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.

1. Thickness: As required for application and in accordance with manufacturer's installation instructions.

D. Remedial Floor Sheet Membrane: Pre-formed multi-ply sheet membrane installed over concrete subfloor and intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.

1. Thickness: 28 mil (0.028 inch) (0.711 mm).

2. Tape: Types recommended by underlayment manufacturer to install membrane and cover seams.

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

A. Perform following operations in the order indicated:

1. Preliminary cleaning.

2. Moisture vapor emission tests; 3 tests in the first 1000 square feet (100 square meters) and one test in each additional 1000 square feet (100 square meters), unless otherwise indicated or required by flooring manufacturer.
3. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
4. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
5. Specified remediation, if required.
6. Patching, smoothing, and leveling, as required.
7. Other preparation specified.
8. Adhesive bond and compatibility test.
9. Protection.

B. Remediations:

1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.
3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

3.02 REMOVAL OF EXISTING FLOOR COVERINGS

A. Comply with local, State, and federal regulations and recommendations of RFCI Recommended Work Practices for Removal of Resilient Floor Coverings, as applicable to floor covering being removed.

B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

3.03 PRELIMINARY CLEANING

A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.

B. Do not use solvents or other chemicals for cleaning.

3.04 MOISTURE VAPOR EMISSION TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F1869 and as follows.

D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per

1000 square feet (1.4 kg per 93 square meters) per 24 hours.

F. Report: Report the information required by the test method.

3.05 INTERNAL RELATIVE HUMIDITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F2170 Procedure A and as follows.

D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.

F. Report: Report the information required by the test method.

3.06 ALKALINITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.

C. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.

D. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch (25 mm) in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

3.07 PREPARATION

A. See individual floor covering section(s) for additional requirements.

B. Comply with requirements and recommendations of floor covering manufacturer.

C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.

D. Do not fill expansion joints, isolation joints, or other moving joints.

3.08 ADHESIVE BOND AND COMPATIBILITY TESTING

A. Comply with requirements and recommendations of floor covering manufacturer.

3.09 APPLICATION OF REMEDIAL FLOOR COATING

A. Comply with requirements and recommendations of coating manufacturer.

3.10 INSTALLATION OF REMEDIAL FLOOR SHEET MEMBRANE

A. Install in accordance with sheet membrane manufacturer's instructions.

3.11 PROTECTION

A. Cover prepared floors with building paper or other durable covering.

END OF SECTION

SECTION 09 0561
COMMON WORK RESULTS FOR FLOORING PREPARATION

OPTIONAL CHECKLIST

1.01 SELECT TYPES OF SUBFLOORS TO BE PREPARED:

A. Concrete, either on-grade or elevated.

B. Wood-based.

1.02 CONCRETE FLOORS: TESTING IS USUALLY REQUIRED FOR ADHESIVELY APPLIED FLOORING.

A. The Contractor will hire the testing agency (all new and existing floor slabs, as applicable).

PART 1 GENERAL

4.01 SECTION INCLUDES

A. This section applies to floors identified in contract documents that are receiving the following types of floor coverings:

1. Resilient tile and sheet.
2. Carpet tile.
3. Thin-set ceramic tile and stone tile.
4. Rubber Flooring.
5. Vinyl Ceramic Tile (VCT).
6. Terrazzo Flooring

B. Removal of existing floor coverings.

C. Preparation of new concrete floor slabs for installation of floor coverings.

D. Testing of concrete floor slabs for moisture and alkalinity (pH).

E. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.

1. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.

F. Patching compound or Ardex should be used for leveling or sloping floor to meet Owner's requirements

G. Remedial floor coatings.

H. Remedial floor sheet membrane.

I. Preparation of new and existing wood-based floors and subfloors for installation of new floor coverings.

4.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Additional requirements relating to testing agencies and testing.

B. Section 01 7419 - Construction Waste Management and Disposal: Handling of existing floor coverings removed.

C. Section 03 3000 - Cast-in-Place Concrete: Moisture emission reducing curing and sealing compound for slabs to receive adhered flooring, to prevent moisture content-related flooring failures; to remain in place,

not to be removed.

D. Section 03 3000 - Cast-in-Place Concrete: Concrete admixture for slabs to receive adhered flooring, to prevent moisture content-related flooring failures.

E. Section 03 5400 - Cast Underlayment: Self-leveling underlayment applied as remediation treatment.

4.03 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens) 2016a.

B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete 1999 (Reapproved 2014).

C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2017.

D. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes 2017.

4.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

4.05 SUBMITTALS

A. Visual Observation Report: For existing floor coverings to be removed.

B. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:

1. Moisture and alkalinity (pH) limits and test methods.
2. Manufacturer's required bond/compatibility test procedure.

C. Testing Agency's Report:

1. Description of areas tested; include floor plans and photographs if helpful.
2. Summary of conditions encountered.
3. Moisture and alkalinity (pH) test reports.
4. Copies of specified test methods.
5. Recommendations for remediation of unsatisfactory surfaces.
6. Product data for recommended remedial coating.
7. Include certification of accuracy by authorized official of testing agency.
8. Submit report to Architect.
9. Submit report not more than two business days after conclusion of testing.

4.06 QUALITY ASSURANCE

A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.

B. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.

1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.

C. Contractor's Responsibility Relating to Independent Agency Testing:

1. Provide access for and cooperate with testing agency.
2. Confirm date of start of testing at least 10 days prior to actual start.
3. Allow at least 4 business days on site for testing agency activities.
4. Achieve and maintain specified ambient conditions.
5. Notify Architect when specified ambient conditions have been achieved and when testing will start.

D. Remedial Coating Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing moisture emission coatings.

4.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products in accordance with manufacturer’s instructions and recommendations.

B. Deliver materials in manufacturer’s packaging; include installation instructions.

C. Keep materials from freezing.

4.08 FIELD CONDITIONS

A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F (18 degrees C) or more than 85 degrees F (30 degrees C).

B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS

5.01 MATERIALS

A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:

1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
2. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.
3. Products:
    a. ARDEX Engineered Cements; ARDEX Feather Finish: www.ardexamericas.com/#sle.

B. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.

C. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.

1. Thickness: As required for application and in accordance with manufacturer's installation instructions.

D. Remedial Floor Sheet Membrane: Pre-formed multi-ply sheet membrane installed over concrete subfloor and intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.

1. Thickness: 28 mil (0.028 inch) (0.711 mm).
2. Tape: Types recommended by underlayment manufacturer to install membrane and cover seams.

PART 3 EXECUTION

6.01 CONCRETE SLAB PREPARATION

A. Perform following operations in the order indicated:

1. Preliminary cleaning.
2. Moisture vapor emission tests; 3 tests in the first 1000 square feet (100 square meters) and one test in each additional 1000 square feet (100 square meters), unless otherwise indicated or required by flooring manufacturer.
3. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
4. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
5. Specified remediation, if required.
6. Patching, smoothing, and leveling, as required.
7. Other preparation specified.
8. Adhesive bond and compatibility test.
9. Protection.

B. Remediations:

1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.
3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

6.02 REMOVAL OF EXISTING FLOOR COVERINGS

A. Comply with local, State, and federal regulations and recommendations of RFCI Recommended Work Practices for Removal of Resilient Floor Coverings, as applicable to floor covering being removed.

B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

6.03 PRELIMINARY CLEANING

A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.

B. Do not use solvents or other chemicals for cleaning.

6.04 MOISTURE VAPOR EMISSION TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F1869 and as follows.

D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet (1.4 kg per 93 square meters) per 24 hours.

F. Report: Report the information required by the test method.

6.05 INTERNAL RELATIVE HUMIDITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F2170 Procedure A and as follows.

D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.

F. Report: Report the information required by the test method.

6.06 ALKALINITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.

C. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.

D. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch (25 mm) in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

6.07 PREPARATION

A. See individual floor covering section(s) for additional requirements.

B. Comply with requirements and recommendations of floor covering manufacturer.

C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.

D. Do not fill expansion joints, isolation joints, or other moving joints.

6.08 APPLICATION OF REMEDIAL FLOOR COATING

A. Comply with requirements and recommendations of coating manufacturer.

6.09 INSTALLATION OF REMEDIAL FLOOR SHEET MEMBRANE

A. Install in accordance with sheet membrane manufacturer's instructions.

6.10 PROTECTION

A. Cover prepared floors with building paper or other durable covering.

END OF SECTION

SECTION 09 2116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Metal stud wall framing.

C. Metal channel ceiling framing.

D. Acoustic insulation.

E. Gypsum sheathing.

F. Cementitious backing board.

G. Gypsum wallboard.

H. Joint treatment and accessories.

I. Textured finish system.

J. Water-resistive barrier over exterior wall sheathing.

K. Acoustic (sound-dampening) wall and ceiling board.

L. Bullet resistant sheathing and wallboard.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

C. Section 07 2100 - Thermal Insulation: Acoustic insulation.

D. Section 07 9200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

E. Section 09 2216 - Non-Structural Metal Framing.

F. Section 31 3116 - Termite Control: Field-applied termiticide and mildewcide for metal framing.

1.03 REFERENCE STANDARDS

A. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units 1999 (Reaffirmed 2016).

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2014.

C. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board 2015.

D. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board 2004 (Reapproved 2014).

E. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing 2003 (Reapproved 2017).

F. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members 2014, with Editorial Revision (2015).

G. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.

H. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products 2017.

I. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board 2018a.

J. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness 2015.

K. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs 2016.

L. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base 2014a.

M. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing 2013a.

N. ASTM C1288 - Standard Specification for Discrete Non-Asbestos Fiber-Cement Interior Substrate Sheets 2017.

O. ASTM C1325 - Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units 2017a.

P. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.

Q. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels 2018a.

R. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels 2018.

S. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2016.

T. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).

U. ASTM E413 - Classification for Rating Sound Insulation 2016.

V. GA-216 - Application and Finishing of Gypsum Panel Products 2016.

W. GA-600 - Fire Resistance Design Manual 2015.

X. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.

C. Product Data: Provide data on metal framing, gypsum board, accessories and joint finishing system.

D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

E. Samples: Submit two samples of gypsum board finished with proposed texture application, 12 by 12 inches (300 by 300 mm) in size, illustrating finish color and texture.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum 5 years of experience.

B. Copies of Documents at Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

1. See PART 3 for finishing requirements.

B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:

1. Acoustic Attenuation: STC of 50-54 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

C. Shaft Walls at HVAC Shafts: Provide completed assemblies with the following characteristics:

1. Air Pressure Within Shaft: Sustained loads of 5 lbf/sq ft (0.24 kPa) with maximum mid-span deflection of L/240.
2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

D. Shaft Walls at Elevator Shafts: Provide completed assemblies with the following characteristics:

1. Air Pressure Within Shaft: Intermittent loads of 5 lbf/sq ft (0.24 kPa) with maximum mid-span deflection of L/240.
2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

E. Fire Rated Assemblies: Provide completed assemblies with the following characteristics:

1. Fire Rated Partitions: UL Listed assembly with hour rating as designated by architect.
2. Head of Fire Rated Partitions: UL Listed assembly with hour rating as designated by architect.
3. Fire Rated Ceilings and Soffits: One (1) hour fire rating.
4. Fire Rated Structural Column Framing: UL Listed assembly with hour rating as designated by architect.
5. Fire Rated Structural Beam Framing: UL Listed assembly with hour rating as designated by architect.
6. Fire Rated Shaft Walls: UL Listed assembly with hour rating as designated by architect.
7. Fire Rated Area Separation Walls: UL Listed assembly with hour rating as designated by architect.
8. ICC IBC Item Numbers: Comply with applicable requirements of ICC IBC for the particular assembly.

2.02 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:

1. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com/#sle.
2. Jaimes Industries: www.jaimesind.com/#sle.
3. Marino: www.marinoware.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of

wall framing of L/120 at 5 psf (L/120 at 240 Pa).

1. Studs: "C" shaped with flat or formed webs with knurled faces.
2. Runners: U shaped, sized to match studs.
3. Ceiling Channels: C-shaped.
4. Furring: Hat-shaped sections, minimum depth of 7/8 inch (22 mm).
5. Resilient Furring Channels: Single or double leg configuration; 1/2 inch (12 mm) channel depth.
    a. Products:
        1) Same manufacturer as other framing materials.
        2) Substitutions: See Section 01 6000 - Product Requirements.

C. Shaft Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.

1. Products:
    a. Same manufacturer as other framing materials.
    b. Substitutions: See Section 01 6000 - Product Requirements.

D. Area Separation Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with specified performance requirements.

1. Products:
    a. Phillips Manufacturing Co; Hemmed H-Stud: www.phillipsmfg.com/#sle.
    b. Substitutions: See Section 01 6000 - Product Requirements.

E. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and fastened as indicated on drawings.

F. Preformed Top Track Firestop Seal:

1. Provide components UL-listed for use in UL-listed fire-rated head of partition joint systems indicated on drawings.
2. Products:
    a. Hilti, Inc; Top Track Seal CFS TTS: www.us.hilti.com/#sle.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:

1. American Gypsum Company: www.americangypsum.com/#sle.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.

1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
    a. Mold-resistant board is required whenever board is being installed before the building is enclosed and conditioned.
3. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
4. Thickness:

a. Multi-Layer Assemblies: Thicknesses as indicated on drawings.

b. All other assemblies: Thicknesses as indicated on drawings.

5. Mold Resistant Paper Faced Products:

a. American Gypsum Company; M-Bloc.

b. CertainTeed Corporation; M2Tech 1/2" Moisture & Mold Resistant Drywall.

c. Continental Building Products; Mold Defense.

d. Substitutions: See Section 01 6000 - Product Requirements.

C. Abuse Resistant Wallboard:

1. Application: High-traffic areas indicated.

2. Surface Abrasion: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.

3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

4. Paper-Faced Type: Gypsum wallboard as defined in ASTM C1396/C1396M.

5. Type: Fire resistance rated Type X, UL or WH listed.

6. Thickness: 5/8 inch (16 mm).

7. Edges: Tapered.

8. Paper-Faced Products:

a. American Gypsum Company; M-Bloc AR Type X.

b. CertainTeed Corporation; Extreme Abuse Resistant Drywall with M2Tech.

c. Continental Building Products; Protecta AR 100 Type X with Mold Defense.

d. Substitutions: See Section 01 6000 - Product Requirements.

D. Impact Resistant Wallboard:

1. Application: High-traffic areas indicated.

2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

3. Type: Fire resistance rated Type X, UL or WH listed.

4. Thickness: as designated on plans.

5. Edges: Tapered.

6. Paper-Faced Products:

a. American Gypsum Company; M-Bloc IR Type X.

b. CertainTeed Corporation; Extreme Impact Resistant Drywall with M2Tech.

c. Continental Building Products; Protecta HIR 300 Type X with Mold Defense.

E. Backing Board For Wet Areas: One of the following products:

1. Application: Surfaces behind tile in wet areas including tub and shower surrounds and shower ceilings.

2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.

a. Thickness: 1/2 inch (12.7 mm).

4. ASTM Cement-Based Board: Non-gypsum-based, cementitious board complying with ASTM C1288.
    a. Thickness: 1/2 inch (12.7 mm).

F. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Ceilings, unless otherwise indicated.
2. Thickness: 1/2 inch (13 mm).
3. Edges: as indicated on drawings.

G. Acoustical Sound Dampening Wall and Ceiling Board: Two layers of heavy paper faced, high density gypsum board separated by a viscoelastic polymer layer and capable of achieving STC rating of 50 or more in typical stud wall assemblies as calculated in accordance with ASTM E413 and when tested in accordance with ASTM E90.
1. Thickness: 1/2 inch (13 mm).
2. Long Edges: Tapered.
3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

H. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
1. Application: Exterior sheathing, unless otherwise indicated.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. Core Type: Regular.
4. Regular Board Thickness: 1/2 inch (13 mm).
5. Edges: Square.

I. Exterior Soffit Board: Exterior gypsum soffit board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Ceilings and soffits in protected exterior areas, unless otherwise indicated.
2. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X.
3. Types: Regular and Type X, in locations indicated.
4. Type X Thickness: 5/8 inch (16 mm).
5. Regular Type Thickness: 1/2 inch (13 mm).
6. Edges: Tapered.

J. Shaftwall and Coreboard: Type X; 1 inch (25 mm) thick by 24 inches (610 mm) wide, beveled long edges, ends square cut.
1. Glass Mat Faced Type: Glass mat shaftliner gypsum panel or glass mat coreboard gypsum panel as defined in ASTM C1658/C1658M.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

2.04 GYPSUM WALLBOARD ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: as indicated on plans.

B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

C. Water-Resistive Barrier: As specified in Section 07 2500.

D. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.

1. Types: As detailed or required for finished appearance.

2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.

3. Products:

a. Same manufacturer as framing materials.

E. Beads, Joint Accessories and Other Trim: ASTM C1047, rigid plastic, galvanized steel or rolled zinc, unless noted otherwise.

1. Corner Beads: Low profile, for 90 degree outside corners.

a. Products:

1) CertainTeed Corporation; No-Coat Drywall Corner: www.certainteed.com/#sle.

2) Phillips Manufacturing Co; Everlast Corner Bead: www.phillipsmfg.com/#sle.

3) Substitutions: See Section 01 6000 - Product Requirements.

2. Splayed Corner Beads with Paper Face: .

a. Products:

1) Substitutions: See Section 01 6000 - Product Requirements.

3. Bullnose Corner Beads with Paper Face: radius as defined on plans.

a. Products:

4. Architectural Reveal Beads:

a. Reveal Depth: as indicated on drawings.

b. Reveal Width: as indicated on drawings.

c. Shapes: As indicated on drawings.

d. Products:

1) Phillips Manufacturing Co; J-400 Reveal Trim: www.phillipsmfg.com/#sle.

2) Trim-Tex, Inc: www.trim-tex.com/#sle.

5. Expansion Joints:

a. Type: V-shaped PVC with tear away fins.

b. Type: V-shaped metal with factory-installed protective tape.

c. Type: Accordian profile with factory-installed protective tape.

d. Type: Off-angle inside corner expansion.

e. Products:

1) Phillips Manufacturing Co; 093 Expansion Control Joint: www.phillipsmfg.com/#sle.

2) Trim-Tex, Inc: www.trim-tex.com/#sle.

F. Decorative Metal Trim:

1. Material: Extruded aluminum alloy 6063-T5 temper.
2. Finish: Anodized, clear.
3. Type: Profile as selected from manufacturer's standard range.
4. Reveal Trim:
    a. Products:
        1) Tamlyn; XtremeInterior Reveal Trim: www.xtremeias.com/#sle.
        2) Substitutions: See Section 01 6000 - Product Requirements.
5. Molding:
    a. Products:
        1) Substitutions: See Section 01 6000 - Product Requirements.

G. Moisture Guard Trim: ASTM C1047, rigid plastic, 48 inch (1219.2 mm) length, applied to bottom edge of gypsum board.
    1. Height: as indicated on drawings.
    2. Depth: as indicated on drawings.
    3. Products:
        a. Waterguard USA; Waterguard: www.waterguard-usa.com/#sle.
        b. Substitutions: See Section 01 6000 - Product Requirements.

H. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.

I. Finishing Compound: Surface coat and primer, takes the place of skim coating.
    1. Products:
        a. CertainTeed Corporation; Quick Prep Plus Interior Prep Coat: www.certainteed.com/#sle.
        b. Substitutions: See Section 01 6000 - Product Requirements.

J. Textured Finish Materials: Latex-based compound; plain.

K. Abuse Resistant Finishes:
    1. Acrylic, water-based, non-textured, high build, tintable primer and surfacer.
    2. Acrylic, integrally colored textured coating.

L. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.

M. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch (0.84 to 2.84 mm) in Thickness: ASTM C954; steel drill screws, corrosion resistant.

N. Nails for Attachment to Wood Members: ASTM C514.

O. Staples For Attachment of Base Ply of Two-Ply Assembly to Wood Members: Flattened galvanized wire type as specified in ASTM C840.

P. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

Q. Adhesive for Attachment to Wood, ASTM C557 and Metal:
    1. Products:

a. Franklin International, Inc; Titebond PROvantage Professional Drywall Adhesive: www.titebond.com/#sle.

b. Liquid Nails, a brand of PPG Architectural Coatings; DWP-24 Drywall Construction Adhesive: www.liquidnails.com/#sle.

c. Substitutions: See Section 01 6000 - Product Requirements.

R. Exterior Soffit Vents: One piece, perforated, ASTM B221 6063 T5 alloy aluminum, with edge suitable for direct application to gypsum board and manufactured especially for soffit application. Provide continuous vent.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 SHAFT WALL INSTALLATION

A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.

1. Install studs at spacing required to meet performance requirements.

B. Shaft Wall Liner: Cut panels to accurate dimension and install sequentially between special friction studs.

3.03 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.

C. Studs: Space studs at 16 inches on center (at 406 mm on center).

1. Extend partition framing to structure where indicated and to ceiling in other locations.

2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.

D. Furring for Fire Ratings: Install as required for fire resistance ratings indicated and to GA-600 requirements.

3.04 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.

1. Seal around all penetrations by conduit, pipe, ducts and rough-in boxes, except where firestopping is provided.

C. Acoustical Shielding: Install in accordance with manufacturer's instructions for application between studs and gypsum board.

3.05 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216 and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

C. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.

1. Seal joints, cut edges, and holes with water-resistant sealant.

2. Paper-Faced Sheathing: Immediately after installation, protect from weather by application of water-resistive barrier.

D. Exterior Soffits: Install exterior soffit board perpendicular to framing, with staggered end joints over framing members or other solid backing.

1. Seal joints, cut edges, and holes with water resistant sealant.

E. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.

F. Installation on Wood Framing: For rated assemblies, comply with requirements of listing authority. For non-rated assemblies, install as follows:

1. Single-Layer Applications: Adhesive application.

G. Bullet Resistant Sheathing and Wallboard:

1. Install bullet resistant sheathing according to manufacturer's written recommendations and with manufacturer approved fasteners.

2. Cover all joints between boards with a 4 inch (102 mm) strip of the same thickness material as the boards, centered on the joint.

3.06 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

D. Decorative Trim: Install at locations shown on drawings and in accordance with manufacturer's instructions.

E. Moisture Guard Trim: Install on bottom edge of gypsum board according to manufacturer's instructions and in locations indicated on drawings.

F. Exterior Soffit Vents: Install according to manufacturer's written instructions and in locations indicated on drawings. Provide vent area specified.

3.07 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:

1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.

2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.

3. Level 3: Walls to receive textured wall finish.

4. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.

5. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.

6. Level 0: Temporary partitions.

7. Level 0: Surfaces indicated to be finished in later stage of project.

B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.

1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).

C. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

D. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.08 TEXTURE FINISH

A. Apply finish texture coating by means of spraying apparatus in accordance with manufacturer's instructions and to match approved sample.

3.09 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

END OF SECTION

SECTION 09 2116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Metal stud wall framing.

C. Metal channel ceiling framing.

D. Acoustic insulation.

E. Gypsum sheathing.

F. Cementitious backing board.

G. Gypsum wallboard.

H. Joint treatment and accessories.

I. Textured finish system.

J. Water-resistive barrier over exterior wall sheathing.

K. Acoustic (sound-dampening) wall and ceiling board.

L. Bullet resistant sheathing and wallboard.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

C. Section 07 2100 - Thermal Insulation: Acoustic insulation.

D. Section 07 9200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

E. Section 09 2216 - Non-Structural Metal Framing.

1.03 REFERENCE STANDARDS

A. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units 1999 (Reaffirmed 2016).

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2014.

C. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board 2015.

D. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board 2004 (Reapproved 2014).

E. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing 2003 (Reapproved 2017).

F. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members 2014, with Editorial Revision (2015).

G. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.

H. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products 2017.

I. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board 2018a.

J. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness 2015.

K. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs 2016.

L. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base 2014a.

M. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing 2013a.

N. ASTM C1288 - Standard Specification for Discrete Non-Asbestos Fiber-Cement Interior Substrate Sheets 2017.

O. ASTM C1325 - Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units 2017a.

P. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.

Q. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels 2018a.

R. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels 2018.

S. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2016.

T. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).

U. ASTM E413 - Classification for Rating Sound Insulation 2016.

V. GA-216 - Application and Finishing of Gypsum Panel Products 2016.

W. GA-600 - Fire Resistance Design Manual 2015.

X. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

Y. UL (FRD) - Fire Resistance Directory Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.

C. Product Data: Provide data on metal framing, gypsum board, accessories and joint finishing system.

D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum [__] years of experience.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

1. See PART 3 for finishing requirements.

B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:

1. Acoustic Attenuation: STC of 50-54 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

C. Shaft Walls at HVAC Shafts: Provide completed assemblies with the following characteristics:

1. Air Pressure Within Shaft: Sustained loads of 5 lbf/sq ft (0.24 kPa) with maximum mid-span deflection of L/240.
2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

D. Shaft Walls at Elevator Shafts: Provide completed assemblies with the following characteristics:

1. Air Pressure Within Shaft: Intermittent loads of 5 lbf/sq ft (0.24 kPa) with maximum mid-span deflection of L/240.
2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

E. Fire Rated Assemblies: Provide completed assemblies with the following characteristics:

1. Fire Rated Partitions: UL listed assembly No. [_____]; [___] hour rating.
2. Head of Fire Rated Partitions: UL listed assembly No. [_____]; [___] hour rating.
3. Fire Rated Ceilings and Soffits: One (1) hour fire rating.
4. Fire Rated Structural Column Framing: UL listed assembly No. [_____]; [___] hour rating.
5. Fire Rated Structural Beam Framing: UL listed assembly No. [_____]; [___] hour rating.
6. Fire Rated Shaft Walls: UL listed assembly No. [_____]; [___] hour rating.
7. Fire Rated Area Separation Walls: UL listed assembly No. [_____]; [___] hour rating.
8. ICC IBC Item Numbers: Comply with applicable requirements of ICC IBC for the particular assembly.
9. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.02 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:

1. Clarkwestern Dietrich Building Systems LLC; [____]: www.clarkdietrich.com/#sle.
2. Jaimes Industries; [____]: www.jaimesind.com/#sle.
3. Marino; [____]: www.marinoware.com/#sle.
4. [_____].
5. [_____].
6. Substitutions: See Section 01 6000 - Product Requirements.

B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf (L/120 at 240 Pa).

1. Studs: "C" shaped with flat or formed webs with knurled faces.
2. Runners: U shaped, sized to match studs.
3. Ceiling Channels: C-shaped.
4. Furring: Hat-shaped sections, minimum depth of 7/8 inch (22 mm).
5. Resilient Furring Channels: Single or double leg configuration; 1/2 inch (12 mm) channel depth.
    a. Products:
        1) Same manufacturer as other framing materials.
        2) [_____].
        3) Substitutions: See Section 01 6000 - Product Requirements.

C. Shaft Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.
    1. Products:
        a. Same manufacturer as other framing materials.
        b. [_____].
        c. [_____].
        d. Substitutions: See Section 01 6000 - Product Requirements.

D. Area Separation Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with specified performance requirements.
    1. Products:
        a. Phillips Manufacturing Co; Hemmed H-Stud: www.phillipsmfg.com/#sle.
        b. [_____].
        c. [_____].
        d. Substitutions: See Section 01 6000 - Product Requirements.

E. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and fastened as indicated on drawings.

F. Preformed Top Track Firestop Seal:
    1. Provide components UL-listed for use in UL-listed fire-rated head of partition joint systems indicated on drawings.
    2. Products:
        a. Hilti, Inc; Top Track Seal CFS TTS: www.us.hilti.com/#sle.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
    1. American Gypsum Company; [____]: www.americangypsum.com/#sle.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
    1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
    2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

a. Mold-resistant board is required whenever board is being installed before the building is enclosed and conditioned.

3. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
4. Thickness:
   a. Vertical Surfaces: [_____] inch ([_____] mm).
   b. Ceilings: [_____] inch ([_____] mm).
   c. [_____]: 1/4 inch (6 mm).
   d. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
5. Mold Resistant Paper Faced Products:
   a. American Gypsum Company; M-Bloc.
   b. CertainTeed Corporation; M2Tech 1/2" Moisture & Mold Resistant Drywall.
   c. Continental Building Products; Mold Defense.
   d. [_____].
   e. [_____].
   f. Substitutions: See Section 01 6000 - Product Requirements.

C. Abuse Resistant Wallboard:
1. Application: High-traffic areas indicated.
2. Surface Abrasion: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
4. Paper-Faced Type: Gypsum wallboard as defined in ASTM C1396/C1396M.
5. Type: Fire resistance rated Type X, UL or WH listed.
6. Thickness: 5/8 inch (16 mm).
7. Edges: Tapered.
8. Paper-Faced Products:
   a. American Gypsum Company; M-Bloc AR Type X.
   b. CertainTeed Corporation; Extreme Abuse Resistant Drywall with M2Tech.
   c. Continental Building Products; Protecta AR 100 Type X with Mold Defense.
   d. [_____].
   e. Substitutions: See Section 01 6000 - Product Requirements.

D. Impact Resistant Wallboard:
1. Application: High-traffic areas indicated.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. Type: Fire resistance rated Type X, UL or WH listed.
4. Thickness: [___] inch ([___] mm).
5. Edges: Tapered.
6. Paper-Faced Products:

a. American Gypsum Company; M-Bloc IR Type X.

b. CertainTeed Corporation; Extreme Impact Resistant Drywall with M2Tech.

c. Continental Building Products; Protecta HIR 300 Type X with Mold Defense.

E. Backing Board For Wet Areas: One of the following products:

1. Application: Surfaces behind tile in wet areas including tub and shower surrounds, shower ceilings and [_____].

2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.

a. Thickness: 1/2 inch (12.7 mm).

4. ASTM Cement-Based Board: Non-gypsum-based, cementitious board complying with ASTM C1288.

a. Thickness: 1/2 inch (12.7 mm).

F. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.

1. Application: Ceilings, unless otherwise indicated.

2. Thickness: [___] inch ([___] mm).

3. Edges: [_____].

G. Acoustical Sound Dampening Wall and Ceiling Board: Two layers of heavy paper faced, high density gypsum board separated by a viscoelastic polymer layer and capable of achieving STC rating of 50 or more in typical stud wall assemblies as calculated in accordance with ASTM E413 and when tested in accordance with ASTM E90.

1. Thickness: 1/2 inch (13 mm).

2. Long Edges: Tapered.

3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

H. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.

1. Application: Exterior sheathing, unless otherwise indicated.

2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

3. Core Type: Regular.

4. Regular Board Thickness: 1/2 inch (13 mm).

5. Edges: Square.

I. Exterior Soffit Board: Exterior gypsum soffit board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.

1. Application: Ceilings and soffits in protected exterior areas, unless otherwise indicated.

2. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X.

3. Types: Regular and Type X, in locations indicated.

4. Type X Thickness: 5/8 inch (16 mm).

5. Regular Type Thickness: 1/2 inch (13 mm).

6. Edges: Tapered.

J. Shaftwall and Coreboard: Type X; 1 inch (25 mm) thick by 24 inches (610 mm) wide, beveled long edges, ends square cut.

1. Glass Mat Faced Type: Glass mat shaftliner gypsum panel or glass mat coreboard gypsum panel as defined in ASTM C1658/C1658M.

2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

2.04 GYPSUM WALLBOARD ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: [_____] inch ([_____] mm).

B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

C. Water-Resistive Barrier: As specified in Section 07 2500.

D. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.

1. Types: As detailed or required for finished appearance.

2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.

3. Products:

a. Same manufacturer as framing materials.

E. Beads, Joint Accessories and Other Trim: ASTM C1047, rigid plastic, galvanized steel or rolled zinc, unless noted otherwise.

1. Corner Beads: Low profile, for 90 degree outside corners.

a. Products:

1) CertainTeed Corporation; No-Coat Drywall Corner: www.certainteed.com/#sle.

2) Phillips Manufacturing Co; Everlast Corner Bead: www.phillipsmfg.com/#sle.

3) [_____].

4) Substitutions: See Section 01 6000 - Product Requirements.

2. Splayed Corner Beads with Paper Face: [____] degree outside corner.

a. Products:

1) [_____].

2) Substitutions: See Section 01 6000 - Product Requirements.

3. Bullnose Corner Beads with Paper Face: [_____] inch ([_____] mm) radius.

a. Products:

4. Architectural Reveal Beads:

a. Reveal Depth: [_____] inch ([_____] mm).

b. Reveal Width: [_____] inch ([_____] mm).

c. Shapes: As indicated on drawings.

d. Products:

1) Phillips Manufacturing Co; J-400 Reveal Trim: www.phillipsmfg.com/#sle.

2) Trim-Tex, Inc; [_____]: www.trim-tex.com/#sle.

5. Expansion Joints:
   a. Type: V-shaped PVC with tear away fins.
   b. Type: V-shaped metal with factory-installed protective tape.
   c. Type: Accordian profile with factory-installed protective tape.
   d. Type: Off-angle inside corner expansion.
   e. Products:
      1) Phillips Manufacturing Co; 093 Expansion Control Joint: www.phillipsmfg.com/#sle.
      2) Trim-Tex, Inc; [_____]: www.trim-tex.com/#sle.

F. Decorative Metal Trim:
   1. Material: Extruded aluminum alloy 6063-T5 temper.
   2. Finish: Anodized, clear.
   3. Type: Profile as selected from manufacturer's standard range.
   4. Reveal Trim:
      a. Products:
         1) Tamlyn; XtremeInterior Reveal Trim: www.xtremeias.com/#sle.
         2) Substitutions: See Section 01 6000 - Product Requirements.
   5. Molding:
      a. Products:
         1) Substitutions: See Section 01 6000 - Product Requirements.

G. Moisture Guard Trim: ASTM C1047, rigid plastic, 48 inch (1219.2 mm) length, applied to bottom edge of gypsum board.
   1. Height: [_____] inch ([_____] mm).
   2. Depth: [_____] inch ([_____] mm).
   3. Products:
      a. Waterguard USA; Waterguard: www.waterguard-usa.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

H. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.

I. Finishing Compound: Surface coat and primer, takes the place of skim coating.
   1. Products:
      a. CertainTeed Corporation; Quick Prep Plus Interior Prep Coat: www.certainteed.com/#sle.
      b. [_____].
      c. Substitutions: See Section 01 6000 - Product Requirements.

J. Textured Finish Materials: Latex-based compound; plain.

K. Abuse Resistant Finishes:
   1. Acrylic, water-based, non-textured, high build, tintable primer and surfacer.

2. Acrylic, integrally colored textured coating.

L. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.

M. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch (0.84 to 2.84 mm) in Thickness: ASTM C954; steel drill screws, corrosion resistant.

N. Nails for Attachment to Wood Members: ASTM C514.

O. Staples For Attachment of Base Ply of Two-Ply Assembly to Wood Members: Flattened galvanized wire type as specified in ASTM C840.

P. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

Q. Adhesive for Attachment to Wood, ASTM C557 and Metal:

1. Products:

a. Franklin International, Inc; Titebond PROvantage Professional Drywall Adhesive: www.titebond.com/#sle.

b. Liquid Nails, a brand of PPG Architectural Coatings; DWP-24 Drywall Construction Adhesive: www.liquidnails.com/#sle.

c. Substitutions: See Section 01 6000 - Product Requirements.

R. Exterior Soffit Vents: One piece, perforated, ASTM B221 6063 T5 alloy aluminum, with edge suitable for direct application to gypsum board and manufactured especially for soffit application. Provide continuous vent.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 SHAFT WALL INSTALLATION

A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.

1. Install studs at spacing required to meet performance requirements.

B. Shaft Wall Liner: Cut panels to accurate dimension and install sequentially between special friction studs.

3.03 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.

C. Studs: Space studs at 16 inches on center (at 406 mm on center).

1. Extend partition framing to structure where indicated and to ceiling in other locations.

2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.

D. Furring for Fire Ratings: Install as required for fire resistance ratings indicated and to GA-600 requirements.

3.04 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.

3.05 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216 and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

C. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.

1. Paper-Faced Sheathing: Immediately after installation, protect from weather by application of water-resistive barrier.

D. Exterior Soffits: Install exterior soffit board perpendicular to framing, with staggered end joints over framing members or other solid backing.

E. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.

F. Installation on Wood Framing: For rated assemblies, comply with requirements of listing authority. For non-rated assemblies, install as follows:

1. Single-Layer Applications: Adhesive application.

G. Bullet Resistant Sheathing and Wallboard:

1. Install bullet resistant sheathing according to manufacturer's written recommendations and with manufacturer approved fasteners.

2. Cover all joints between boards with a 4 inch (102 mm) strip of the same thickness material as the boards, centered on the joint.

3.06 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

D. Decorative Trim: Install at locations shown on drawings and in accordance with manufacturer's instructions.

E. Moisture Guard Trim: Install on bottom edge of gypsum board according to manufacturer's instructions and in locations indicated on drawings.

F. Exterior Soffit Vents: Install according to manufacturer's written instructions and in locations indicated on drawings. Provide vent area specified.

3.07 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:

1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.

2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.

3. Level 3: Walls to receive textured wall finish.

4. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.

5. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.

6. Level 0: Temporary partitions.
7. Level 0: Surfaces indicated to be finished in later stage of project.

B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).

C. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

D. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.08 TEXTURE FINISH

A. Apply finish texture coating by means of spraying apparatus in accordance with manufacturer's instructions and to match approved sample.

3.09 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

END OF SECTION

SECTION 09 2216
NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal partition, ceiling and soffit framing.

B. Framing accessories.

1.02 RELATED REQUIREMENTS

A. Section 05 2100 - Steel Joists: Execution requirements for anchors for attaching work of this section.

B. Section 05 4000 - Cold-Formed Metal Framing: Structural load bearing metal stud framing and Exterior wall stud framing.

C. Section 05 4000 - Cold-Formed Metal Framing: Execution requirements for anchors for attaching work of this section.

D. Section 05 5000 - Metal Fabrications: Metal fabrications attached to stud framing.

E. Section 07 2100 - Thermal Insulation: Acoustic insulation.

F. Section 07 6200 - Sheet Metal Flashing and Trim: Head and sill flashings

G. Section 08 3100 - Access Doors and Panels.

H. Section 08 5113 - Aluminum Windows: Product requirements for window anchors.

I. Section 09 2116 - Gypsum Board Assemblies: Metal studs for gypsum board partition framing.

1.03 REFERENCE STANDARDS

A. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members 2014, with Editorial Revision (2015).

B. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products 2017.

C. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).

D. ASTM E413 - Classification for Rating Sound Insulation 2016.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:

1. Indicate prefabricated work, component details, stud layout, framed openings, anchorage to structure, acoustic details, type and location of fasteners, accessories and items of other related work.

2. Describe method for securing studs to tracks, splicing, and for blocking and reinforcement of framing connections.

C. Product Data: Provide data describing framing member materials and finish, product criteria, load charts and limitations.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

E. Sustainable Design Submittal: Documentation of recycled content and location of manufacture.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by manufacturer.

1.06 MOCK-UP

A. Provide mock-up of stud wall, ceiling and soffit framing including insulation, sheathing, window frame and door frame and finish specified in other sections. Coordinate with installation of associated work specified in other sections.

1. Mock-up may remain as part of the Work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Framing, Connectors, and Accessories:

1. CEMCO; [____]: www.cemcosteel.com/#sle.
2. ClarkDietrich Building Systems; [_____]: www.clarkdietrich.com/#sle.
3. Jaimes Industries; [____]: www.jaimesind.com/#sle.
4. [_____].
5. [_____].
6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FRAMING MATERIALS

A. Fire Rated Assemblies: Comply with applicable code and as follows:

1. Fire Rated Partitions: Listed assembly by UL, No. [____] ; [___] hour rating.
2. Top of Fire Rated Partitions: Listed assembly by UL, No. [____] ; [___] hour rating.
3. Fire Rated Ceiling and Soffits: Listed assembly by UL, No. [____] ; [___] hour rating.
4. Fire Rated Structural Column Framing: Listed assembly by UL, No. [____] ; [___] hour rating.
5. Fire Rated Structural Beam Framing: Listed assembly by UL, No. [____] ; [___] hour rating.
6. Fire Rated Shaft Wall Requirements: Listed assembly by UL, No. [___] ; [___] hour rating.

B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf (L/240 at 240 Pa).

1. Studs: C shaped with flat or formed webs with knurled faces.
2. Runners: U shaped, sized to match studs.
3. Ceiling Channels: C shaped.
4. Furring: Hat-shaped sections, minimum depth of 7/8 inch (22 mm).

C. Partition Head to Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and braced with continuous bridging on both sides.

D. Deflection and Firestop Track: Intumescent strip factory-applied to track flanges expands when exposed to heat or flames to provide a perimeter joint seal.

E. Preformed Top Track Firestop Seal:

1. Provide components UL-listed for use in UL-listed fire-rated head of partition joint systems indicated on drawings.
2. Products:
    a. Hilti, Inc; Top Track Seal CFS TTS: www.us.hilti.com/#sle.
    b. [_____].
    c. Substitutions: See Section 01 6000 - Product Requirements.

2.03 FABRICATION

A. Fabricate assemblies of framed sections to sizes and profiles required.

B. Fit, reinforce, and brace framing members to suit design requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

3.02 INSTALLATION OF STUD FRAMING

A. Extend partition framing to structure where indicated and to ceiling in other locations.

B. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.

C. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

D. Align and secure top and bottom runners at 24 inches (600 mm) on center.

E. At partitions indicated with an acoustic rating:

1. Provide components and install as required to produce STC rating of [____], based on published tests by manufacturer conducted in accordance with ASTM E90 with STC rating calculated in accordance with ASTM E413.

F. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.

G. Align stud web openings horizontally.

H. Secure studs to tracks using crimping method. Do not weld.

I. Fabricate corners using a minimum of three studs.

J. Double stud at wall openings, door and window jambs, not more than 2 inches (50 mm) from each side of openings.

K. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.

L. Furring: Install at spacing and locations shown on drawings. Lap splices a minimum of 6 inches (150 mm).

3.03 CEILING AND SOFFIT FRAMING

A. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.

B. Install furring independent of walls, columns, and above-ceiling work.

C. Securely anchor hangers to structural members or embed in structural slab. Space hangers as required to limit deflection to criteria indicated. Use rigid hangers at exterior soffits.

D. Space main carrying channels at maximum 72 inch (1 800 mm) on center, and not more than 6 inches (150 mm) from wall surfaces. Lap splice securely.

E. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.

F. Place furring channels perpendicular to carrying channels, not more than 2 inches (50 mm) from perimeter walls, and rigidly secure. Lap splices securely.

G. Reinforce openings in suspension system that interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum 24 inches (600 mm) past each opening.

3.04 TOLERANCES

A. Maximum Variation From True Position: 1/8 inch in 10 feet (3 mm in 3 m).

B. Maximum Variation From Plumb: 1/8 inch in 10 feet (3 mm in 3 m).

END OF SECTION

SECTION 09 2216
NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal partition, ceiling and soffit framing.

B. Framing accessories.

1.02 RELATED REQUIREMENTS

A. Section 05 2100 - Steel Joists: Execution requirements for anchors for attaching work of this section.

B. Section 05 4000 - Cold-Formed Metal Framing: Structural load bearing metal stud framing and Exterior wall stud framing.

C. Section 05 4000 - Cold-Formed Metal Framing: Execution requirements for anchors for attaching work of this section.

D. Section 05 5000 - Metal Fabrications: Metal fabrications attached to stud framing.

E. Section 07 2100 - Thermal Insulation: Acoustic insulation.

F. Section 07 6200 - Sheet Metal Flashing and Trim: Head and sill flashings

G. Section 08 3100 - Access Doors and Panels.

H. Section 08 5113 - Aluminum Windows: Product requirements for window anchors.

I. Section 09 2116 - Gypsum Board Assemblies: Metal studs for gypsum board partition framing.

1.03 REFERENCE STANDARDS

A. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members 2014, with Editorial Revision (2015).

B. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products 2017.

C. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).

D. ASTM E413 - Classification for Rating Sound Insulation 2016.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:

1. Indicate prefabricated work, component details, stud layout, framed openings, anchorage to structure, acoustic details, type and location of fasteners, accessories and items of other related work.

2. Describe method for securing studs to tracks, splicing, and for blocking and reinforcement of framing connections.

C. Product Data: Provide data describing framing member materials and finish, product criteria, load charts and limitations.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

E. Sustainable Design Submittal: Documentation of recycled content and location of manufacture.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by manufacturer.

1.06 MOCK-UP

A. Provide mock-up of stud wall, ceiling and soffit framing including insulation, sheathing, window frame and door frame and finish specified in other sections. Coordinate with installation of associated work specified in other sections.

1. Mock-up may remain as part of the Work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Framing, Connectors, and Accessories:

1. CEMCO: www.cemcosteel.com/#sle.
2. ClarkDietrich Building Systems: www.clarkdietrich.com/#sle.
3. Jaimes Industries: www.jaimesind.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FRAMING MATERIALS

A. Fire Rated Assemblies: Comply with applicable code and as follows:

1. Fire Rated Partitions: UL Listed assembly with hour rating as designated by architect.
2. Top of Fire Rated Partitions: UL Listed assembly with hour rating as designated by architect.
3. Fire Rated Ceiling and Soffits: UL Listed assembly with hour rating as designated by architect.
4. Fire Rated Structural Column Framing: UL Listed assembly with hour rating as designated by architect.
5. Fire Rated Structural Beam Framing: UL Listed assembly with hour rating as designated by architect.
6. Fire Rated Shaft Wall Requirements: UL Listed assembly with hour rating as designated by architect.

B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf (L/240 at 240 Pa).

1. Studs: C shaped with flat or formed webs with knurled faces.
2. Runners: U shaped, sized to match studs.
3. Ceiling Channels: C shaped.
4. Furring: Hat-shaped sections, minimum depth of 7/8 inch (22 mm).

C. Partition Head to Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and braced with continuous bridging on both sides.

D. Deflection and Firestop Track: Intumescent strip factory-applied to track flanges expands when exposed to heat or flames to provide a perimeter joint seal.

E. Preformed Top Track Firestop Seal:

1. Provide components UL-listed for use in UL-listed fire-rated head of partition joint systems indicated on drawings.
2. Products:
    a. Hilti, Inc; Top Track Seal CFS TTS: www.us.hilti.com/#sle.
    b. Substitutions: See Section 01 6000 - Product Requirements.

2.03 FABRICATION

A. Fabricate assemblies of framed sections to sizes and profiles required.

B. Fit, reinforce, and brace framing members to suit design requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

3.02 INSTALLATION OF STUD FRAMING

A. Extend partition framing to structure where indicated and to ceiling in other locations.

B. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.

C. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

D. Align and secure top and bottom runners at 24 inches (600 mm) on center.

E. At partitions indicated with an acoustic rating:

1. Provide components and install as required to produce STC ratings as indicated, based on published tests by manufacturer conducted in accordance with ASTM E90 with STC rating calculated in accordance with ASTM E413.

F. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.

G. Align stud web openings horizontally.

H. Secure studs to tracks using crimping method. Do not weld.

I. Fabricate corners using a minimum of three studs.

J. Double stud at wall openings, door and window jambs, not more than 2 inches (50 mm) from each side of openings.

K. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.

L. Furring: Install at spacing and locations shown on drawings. Lap splices a minimum of 6 inches (150 mm).

3.03 CEILING AND SOFFIT FRAMING

A. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.

B. Install furring independent of walls, columns, and above-ceiling work.

C. Securely anchor hangers to structural members or embed in structural slab. Space hangers as required to limit deflection to criteria indicated. Use rigid hangers at exterior soffits.

D. Space main carrying channels at maximum 72 inch (1 800 mm) on center, and not more than 6 inches (150 mm) from wall surfaces. Lap splice securely.

E. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.

F. Place furring channels perpendicular to carrying channels, not more than 2 inches (50 mm) from perimeter walls, and rigidly secure. Lap splices securely.

G. Reinforce openings in suspension system that interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum 24 inches (600 mm) past each opening.

3.04 TOLERANCES

A. Maximum Variation From True Position: 1/8 inch in 10 feet (3 mm in 3 m).

B. Maximum Variation From Plumb: 1/8 inch in 10 feet (3 mm in 3 m).

END OF SECTION

SECTION 09 2983
GYPSUM BOARD SOFFITS

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Furnish all labor, materials, tools, equipment and services necessary for and reasonably incidental to complete the gypsum board s0ffit work as indicated on the drawings or specified, including, but not limited to, the following:

1. Gypsum Board
2. Metal Studs
3. Taping and Joint Treatment
4. Soffit Suspension System
5. Trim

1.02 RELATED SECTIONS:

A. Section 06100: Rough Carpentry

1.03 QUALITY ASSURANCE:

A. Perform gypsum board systems work in accordance with recommendations of ASTM C754 and GA 216, unless otherwise specified in this section.

1.04 SUBMITTALS:

A. Material submittals will include manufacturer’s cut sheets for all materials to be used indicating suitability in exterior soffit installations.

1. Gypsum Board (must be moisture resistant and suitable for exterior use).
2. Joint Tape
3. Joint Compound (must be setting type suitable for exterior use).
4. Galvanized metal trims

PART 2 - PRODUCTS

2.01 METAL FRAMING:

A. Provide metal framing materials in accordance with GA 216.

B. Studs: Screw-type C-shaped, as manufactured by U.S.G. ST Series, or approved equal, of the following type:

C. Runners or Track: Match stud gauge.

D. Furring Members: Screw-type hat-shaped and Screw-type C-shaped; 20 gauge.

E. Channels, Hager Wire, Fasteners and anchorages: GA 216.

2.02 METAL FRAMING ACCESSORIES:

A. Blocking: Fire-retardant 2 x wood or 1-1/2" steel channels.

B. Screws: ASTM C1002, Type S, bugle head, chromate or factory painted, 1" long for single ply, 1-1/2" long for double layer board.

2.03 GYPSUM BOARD:

A. Provide Fire-Rated Gypsum Board ASTM C36 5/8" thick, maximum permissible length, ends square cut, tapered edges. Fire-rated gypsum board shall be used.

B. USG SHEETROCK brand Exterior Gypsum Ceiling Board 5/8” type X core Exterior Soffit Wallboard or pre-approved equal, screwed and attached to existing wood or metal framing or new 20 gauge framing or hat channels spaced 16” o.c with 1-1/4” long Type S screw spaced 8” o.c. along edges and 12” o.c. in the field of the board. All gypsum wallboard used must be factory marked Exterior Soffit or exterior ceiling.

2.04 GYPSUM BOARD ACCESSORIES:

A. Provide gypsum board accessories in accordance with GA 216.

B. Corner Beads: USG Dur-A-Bead, or approved equal.

C. Metal Edge Trim: Galvanized, USG No. 200B and 200A.

D. Reinforcing Tape: USG Fiberglass Tape, or approved equal.

E. Joint Compound: USG SHETROCK brand DURABOND setting-type joint compound or approved equal.

F. Soffit Vents : Provide round aluminum soffit vents matching size of soffit vents in existing areas of gypsum soffit. Install vents per gypsum wallboard manufacturer’s ventilation requirements. All gypsum board ceiling areas must be vented.

G. Control Joints. Provide control joints at corners and every 25 ‘ consisting of two pieces of J-Trim back to back.

PART 3 - EXECUTION

3.01 METAL FRAMING ERECTION - GENERAL:

A. Install metal framing in accordance with ASTM C754.

B. Install members true to lines and levels to provide surface flatness with maximum variation of 1/8" in 10' in any direction.

C. Install gypsum board in accordance with Gypsum Association Document GA-216-85.

3.02 GYPSUM BOARD INSTALLATION:

A. Install gypsum soffit board in accordance with manufacturer’s recommendations. Gypsum board must be marked by the manufacturer as ‘Exterior Soffit or Exterior Ceiling’.

B. Erect single layer standard gypsum board across framing members with ends and edges occurring over framing.

C. Use Type S chromate or painted screws specifically designed for exterior use when fastening gypsum board to metal furring or framing.

D. Place galvanized edge trim where gypsum board abuts dissimilar materials.

E. Tape, fill and sand exposed joints, edges, corners, openings and fixings, to produce a surface ready to receive surface finishes. Feather coats onto adjoining surfaces so that camber is maximum 1/16". Use only setting type joint mix suitable for exterior applications.

F. Remove and re-do defective work. Finishers must be experienced with fast setting joint compound. Do not paint poorly finished surfaces until restored to acceptable smoothness.

3.03 GYPSUM SOFFIT BOARD PAINTING:

A. Number of coats:

1. 1st Coat -Exterior Alkyd/Oil House Paint Primer – Killz or Equal

2. 2nd Coat – Premium Acrylic Exterior Latex House Paint by Sherwin Williams or equal.

3. 3rd Coat – Premium Acrylic Exterior Latex House Paint by Sherwin Williams or equal.

B. Gloss: - Match gloss of adjacent gypsum ceiling areas. Avoid high gloss and gloss finishes.

C. Color: - Match color and shade of adjacent gypsum ceiling areas (white).

3.04 INSULATION:

A. Replace any disrupted insulation in kind.

B. Replace any damaged insulation with new insulation of the same type.

END OF SECTION

SECTION 09 2983
GYPSUM BOARD SOFFITS

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Furnish all labor, materials, tools, equipment and services necessary for and reasonably incidental to complete the gypsum board s0ffit work as indicated on the drawings or specified, including, but not limited to, the following:

1. Gypsum Board
2. Metal Studs
3. Taping and Joint Treatment
4. Soffit Suspension System
5. Trim

1.02 RELATED SECTIONS:

A. Section 06100: Rough Carpentry

1.03 QUALITY ASSURANCE:

A. Perform gypsum board systems work in accordance with recommendations of ASTM C754 and GA 216, unless otherwise specified in this section.

1.04 SUBMITTALS:

A. Material submittals will include manufacturer’s cut sheets for all materials to be used indicating suitability in exterior soffit installations.

1. Gypsum Board (must be moisture resistant and suitable for exterior use).
2. Joint Tape
3. Joint Compound (must be setting type suitable for exterior use).
4. Galvanized metal trims

PART 2 - PRODUCTS

2.01 METAL FRAMING:

A. Provide metal framing materials in accordance with GA 216.

B. Studs: Screw-type C-shaped, as manufactured by U.S.G. ST Series, or approved equal, of the following type:

C. Runners or Track: Match stud gauge.

D. Furring Members: Screw-type hat-shaped and Screw-type C-shaped; 20 gauge.

E. Channels, Hager Wire, Fasteners and anchorages: GA 216.

2.02 METAL FRAMING ACCESSORIES:

A. Blocking: Fire-retardant 2 x wood or 1-1/2" steel channels.

B. Screws: ASTM C1002, Type S, bugle head, chromate or factory painted, 1" long for single ply, 1-1/2" long for double layer board.

2.03 GYPSUM BOARD:

A. Provide Fire-Rated Gypsum Board ASTM C36 5/8" thick, maximum permissible length, ends square cut, tapered edges. Fire-rated gypsum board shall be used.

B. USG SHEETROCK brand Exterior Gypsum Ceiling Board 5/8” type X core Exterior Soffit Wallboard or pre-approved equal, screwed and attached to existing wood or metal framing or new 20 gauge framing or hat channels spaced 16” o.c with 1-1/4” long Type S screw spaced 8” o.c. along edges and 12” o.c. in the field of the board. All gypsum wallboard used must be factory marked Exterior Soffit or exterior ceiling.

2.04 GYPSUM BOARD ACCESSORIES:

A. Provide gypsum board accessories in accordance with GA 216.

B. Corner Beads: USG Dur-A-Bead, or approved equal.

C. Metal Edge Trim: Galvanized, USG No. 200B and 200A.

D. Reinforcing Tape: USG Fiberglass Tape, or approved equal.

E. Joint Compound: USG SHETROCK brand DURABOND setting-type joint compound or approved equal.

F. Soffit Vents : Provide round aluminum soffit vents matching size of soffit vents in existing areas of gypsum soffit. Install vents per gypsum wallboard manufacturer’s ventilation requirements. All gypsum board ceiling areas must be vented.

G. Control Joints. Provide control joints at corners and every 25 ‘ consisting of two pieces of J-Trim back to back.

PART 3 - EXECUTION

3.01 METAL FRAMING ERECTION - GENERAL:

A. Install metal framing in accordance with ASTM C754.

B. Install members true to lines and levels to provide surface flatness with maximum variation of 1/8" in 10' in any direction.

C. Install gypsum board in accordance with Gypsum Association Document GA-216-85.

3.02 GYPSUM BOARD INSTALLATION:

A. Install gypsum soffit board in accordance with manufacturer’s recommendations. Gypsum board must be marked by the manufacturer as ‘Exterior Soffit or Exterior Ceiling’.

B. Erect single layer standard gypsum board across framing members with ends and edges occurring over framing.

C. Use Type S chromate or painted screws specifically designed for exterior use when fastening gypsum board to metal furring or framing.

D. Place galvanized edge trim where gypsum board abuts dissimilar materials.

E. Tape, fill and sand exposed joints, edges, corners, openings and fixings, to produce a surface ready to receive surface finishes. Feather coats onto adjoining surfaces so that camber is maximum 1/16". Use only setting type joint mix suitable for exterior applications.

F. Remove and re-do defective work. Finishers must be experienced with fast setting joint compound. Do not paint poorly finished surfaces until restored to acceptable smoothness.

3.03 GYPSUM SOFFIT BOARD PAINTING:

A. Number of coats:

1. 1st Coat -Exterior Alkyd/Oil House Paint Primer – Killz or Equal

2. 2nd Coat – Premium Acrylic Exterior Latex House Paint by Sherwin Williams or equal.

3. 3rd Coat – Premium Acrylic Exterior Latex House Paint by Sherwin Williams or equal.

B. Gloss: - Match gloss of adjacent gypsum ceiling areas. Avoid high gloss and gloss finishes.

C. Color: - Match color and shade of adjacent gypsum ceiling areas (white).

3.04 INSULATION:

A. Replace any disrupted insulation in kind.

B. Replace any damaged insulation with new insulation of the same type.

END OF SECTION

SECTION 09 3000
TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Tile for counters.

D. Tile for shower receptors.

E. Cementitious backer board as tile substrate.

F. Stone thresholds.

G. Ceramic accessories.

H. Ceramic trim.

I. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium). 2017.

B. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive 2013 (Revised).

C. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar 2012 (Revised).

D. ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation 2010 (Reaffirmed 2016).

E. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units 1999 (Reaffirmed 2016).

F. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes For Thin-Set Ceramic Tile And Dimension Stone Installation 2014.

G. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation 2014.

H. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar 2012.

I. ANSI A137.1 - American National Standard Specifications for Ceramic Tile 2012.

J. ANSI A137.2 - American National Standard Specifications for Glass Tile 2013.

K. ASTM C150/C150M - Standard Specification for Portland Cement 2018.

L. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2016, with Editorial Revision (2016).

M. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products 2017.

N. ASTM D4068 - Standard Specification for Chlorinated Polyethylene (CPE) Sheeting for Concealed Water-Containment Membrane 2017.

O. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation 2017.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories and setting details.

C. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches (457 by 457 mm) in size illustrating pattern, color variations, and grout joint size variations.

1.05 QUALITY ASSURANCE

A. Maintain one copy of and ANSI A108/A118/A136 and TCNA (HB) on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.

C. Installer Qualifications: Company specializing in performing tile installation, with minimum of five years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.

B. Maintain ambient and substrate temperature of 50 degrees F (10 degrees C) during installation of mortar materials.

PART 2 PRODUCTS

2.01 TILE

A. Manufacturers: All products by the same manufacturer.

1. Dal-Tile Corporation: www.daltile.com/#sle.
2. Terrazzo & Marble Supply Companies: www.tmsupply.com/#sle.
3. [_____].
4. [_____].
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Ceramic Mosaic Tile, Type [__]: ANSI A137.1 standard grade.

1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
2. Products:
    a. [_____].
    b. [_____].
    c. Substitutions: See Section 01 6000 - Product Requirements.

C. Glazed Wall Tile, Type [__]: ANSI A137.1 standard grade.

1. Moisture Absorption: 7.0 to 20.0 percent as tested in accordance with ASTM C373.
2. Trim Units: Matching bead, bullnose, cove and base shapes in sizes coordinated with field tile.

3. Products:
    a. [_____].
    b. [_____].
    c. Substitutions: See Section 01 6000 - Product Requirements.

D. Quarry Tile, Type [__]: ANSI A137.1 standard grade.
1. Moisture Absorption: 0.5 to 3.0 percent as tested in accordance with ASTM C373.
2. Trim Units: Matching bullnose, cove, cove base and window sill or step nosing shapes in sizes coordinated with field tile.
3. Products:
    a. Metropolitan Ceramics: www.metroceramics.com/#sle.
    b. Summitville Tiles, Inc: www.summitville.com/#sle.
    c. [_____].
    d. [_____].
    e. Substitutions: See Section 01 6000 - Product Requirements.

E. Porcelain Tile, Type [_____]: ANSI A137.1 standard grade.
1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
2. Trim Units: Matching bullnose, double bullnose, cove base and cove shapes in sizes coordinated with field tile.
3. Products:
    a. [_____].
    b. [_____].
    c. Substitutions: See Section 01 6000 - Product Requirements.

F. Natural Stone Tile, Type [__]:
1. Composition: [_____].
2. Products:
    a. Diamond Tech Tiles; [_____]: www.dttiles.com/#sle.
    b. [_____].
    c. [_____].

G. Artificial Stone Tile, Type [__]:
1. Composition: 93 percent aggregate, quartz and recycled glass.
2. Products:
    a. Terrazzo & Marble Supply Companies; DIFINITI Quartz: www.tmsupply.com/#sle.
    b. Substitutions: See Section 01 6000 - Product Requirements.

H. Glass Tile, Type [__]: ANSI A137.2 standard grade.

I. Terrazzo Tile, Type [__]:
1. Composition: Portland cement, ASTM C150/C150M; aggregate complying with ASTM C33/C33M.
2. Products:

a. Tectura Designs, a division of Wausau Tile Inc; Terrazzo Tile: www.tecturadesigns.com/#sle.

b. [_____].

c. [_____].

d. Substitutions: See Section 01 6000 - Product Requirements.

2.02 TRIM AND ACCESSORIES

A. Ceramic Accessories: Glazed finish, same color and finish as adjacent field tile; same manufacturer as tile.

1. Soap Dish: With handle, clam shell design, recess mounted; cast strength sufficient to resist lateral pull force of 75 lbs (34 Kg).

2. Toilet Tissue Holder: Recessed, for single roll, with spring loaded holder.

3. Towel Bars: Standard design, surface mounted with extensions for casting into small wall openings; cast strength sufficient to resist lateral pull force of 30 lbs (14 Kg).

B. Ceramic Trim: Matching bullnose, double bullnose, cove base and cove ceramic shapes in sizes coordinated with field tile.

1. Applications:

a. Open Edges: Bullnose.

b. Inside Corners: Jointed.

c. Floor to Wall Joints: Cove base.

2. Manufacturers: Same as for tile.

C. Non-Ceramic Trim: Satin brass anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.

1. Applications:

a. Open edges of wall tile.

b. Open edges of floor tile.

c. Wall corners, outside and inside.

d. Transition between floor finishes of different heights.

e. Thresholds at door openings.

f. Expansion and control joints, floor and wall.

g. Floor to wall joints.

h. Borders and other trim as indicated on drawings.

i. Balcony and terrace edge trim and fascia.

2. Manufacturers:

a. Schluter-Systems: www.schluter.com/#sle.

b. Genesis APS International: www.genesis-aps.com/#sle.

c. [_____].

d. Substitutions: See Section 01 6000 - Product Requirements.

D. Thresholds: Marble, white or gray, honed finish; 2 inches (51 mm) wide by full width of wall or frame opening; 1/2 inch thick (12.7 mm thick); beveled one long edge with radiused corners on top side; without

holes, cracks, or open seams.

1. Applications:
    a. At doorways where tile terminates.

2.03 SETTING MATERIALS

A. Manufacturers:
    1. ARDEX Engineered Cements; [_____]: www.ardexamericas.com/#sle.
    2. Bostik Inc; [_____]: www.bostik-us.com/#sle.
    3. Custom Building Products; [_____]: www.custombuildingproducts.com/#sle.
    4. [_____].
    5. [_____].
    6. Substitutions: See Section 01 6000 - Product Requirements.

B. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.
    1. Applications: Use this type of bond coat where indicated and where no other type of bond coat is indicated.
    2. Products:
        a. ARDEX Engineered Cements; ARDEX N 23 MICROTEC: www.ardexamericas.com/#sle.

C. Improved Latex-Portland Cement Mortar Bond Coat: ANSI A118.15.
    1. Applications: Use this type of bond coat where indicated and where no other type of bond coat is indicated.
    2. Products:
        a. ARDEX Engineered Cements; S 28: www.ardexamericas.com/#sle.
        b. Substitutions: See Section 01 6000 - Product Requirements.

D. Epoxy Adhesive and Mortar Bond Coat: ANSI A118.3.
    1. Applications: Where indicated on drawings.
    2. Products:
        a. Custom Building Products; EBM-Lite Epoxy Bonding Mortar: www.custombuildingproducts.com/#sle.
        b. LATICRETE International, Inc; LATICRETE LATAPOXY 300 Adhesive: www.laticrete.com/#sle.
        c. [_____].
        d. Substitutions: See Section 01 6000 - Product Requirements.

E. Water Based Adhesive: Multi-purpose type mastic.
    1. Applications: [_____].
    2. Products:
        a. Stauf USA, LLC; M420 Spot Tack: www.staufusa.com/#sle.
        b. [_____].
        c. [_____].
        d. Substitutions: See Section 01 6000 - Product Requirements.

F. Mortar Bed Materials: Pre-packaged mix of Portland cement, sand, latex additive, and water.

1. Products:

a. LATICRETE International, Inc; LATICRETE 3701 Fortified Mortar Bed: www.laticrete.com/#sle.

b. [_____].

c. [_____].

d. Substitutions: See Section 01 6000 - Product Requirements.

2.04 GROUTS

A. Manufacturers:

1. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: www.laticrete.com/#sle.

2. [_____].

3. [_____].

B. Standard Grout: ANSI A118.6 standard cement grout.

1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.

2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.

3. Color(s): As selected by Architect from manufacturer's full line.

4. Products:

a. Custom Building Products; Polyblend Non-Sanded Grout: www.custombuildingproducts.com/#sle.

b. LATICRETE International, Inc; LATICRETE 1500 Sanded Grout: www.laticrete.com/#sle.

c. [_____].

d. Substitutions: See Section 01 6000 - Product Requirements.

C. Stain Resistant Grout Additive: Liquid admixture for sanded and unsanded cement-based grouts; mix with dry grout material in place of water.

1. Applications: Where indicated.

2.05 MAINTENANCE MATERIALS

A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.

1. Applications: Between tile and plumbing fixtures.

2. Color(s): As indicated on drawings.

3. Products:

a. ARDEX Engineered Cements; ARDEX SX: www.ardexamericas.com/#sle.

b. LATICRETE International, Inc; LATICRETE LATASIL: www.laticrete.com/#sle.

c. [_____].

d. [_____].

e. Substitutions: See Section 01 6000 - Product Requirements.

B. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.

1. Composition: Water-based colorless silicone.
2. Products:
    a. Merkrete, by Parex USA, Inc; Merkrete Grout Sealer: www.merkrete.com/#sle.
    b. [_____].
    c. [_____].
    d. Substitutions: See Section 01 6000 - Product Requirements.

C. Tile Sealer: Stain protection for natural stone.
1. Products:
    a. Custom Building Products; Aqua Mix Enrich 'N' Seal: www.custombuildingproducts.com/#sle.
    b. STONETECH, a division of LATICRETE international, Inc; STONETECH Heavy Duty Stone Sealer: www.laticrete.com/#sle.
    c. [_____].
    d. Substitutions: See Section 01 6000 - Product Requirements.

D. Grout Release: Temporary, water-soluble pre-grout coating.
1. Products:
    a. Custom Building Products; Aqua Mix Grout Release: www.custombuildingproducts.com/#sle.

2.06 ACCESSORY MATERIALS

A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
1. Thickness: [____] mils ([____] mm), maximum.
2. Crack Resistance: No failure at 1/16 inch (1.6 mm) gap, minimum.

B. Waterproofing Membrane at Floors: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
1. Crack Resistance: No failure at 1/16 inch (1.6 mm) gap, minimum; comply with ANSI A118.12.
2. Fluid or Trowel Applied Type:
    a. Products:
        1) ARDEX Engineered Cements; ARDEX 8+9: www.ardexamericas.com/#sle.
        2) LATICRETE International, Inc; LATICRETE HYDRO BAN: www.laticrete.com/#sle.
        3) [_____].

C. Waterproofing Membrane at Showers and Tiled Tubs: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
1. Fluid or Trowel Applied Type:
    a. Material: Acrylic.
    b. Products:
        1) ARDEX Engineered Cements; ARDEX 8+9: www.ardexamericas.com/#sle.
        2) [_____].
        3) [_____].

4) Substitutions: See Section 01 6000 - Product Requirements.

2. Peel-and-Stick Sheet Type:

D. Waterproofing Membrane Under Thick Mortar Bed at Showers and Tiled Tubs:

1. Material: Chlorinated polyethylene sheet, 40 mils (1.0 mm) thick, minimum; complying with ASTM D4068.

2. Products:

a. Noble Company; Chloraloy Shower Pan Liner: www.noblecompany.com/#sle.

b. [_____].

c. [_____].

E. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 1/2 inch (12.7 mm) thick; 2 inch (51 mm) wide coated glass fiber tape for joints and corners.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.

3.02 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

E. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

A. Install tile, thresholds and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, manufacturer's instructions, and TCNA (HB) recommendations.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles bullnosed.

F. Install ceramic accessories rigidly in prepared openings.

G. Install non-ceramic trim in accordance with manufacturer's instructions.

H. Install thresholds where indicated.

I. Sound tile after setting. Replace hollow sounding units.

J. Keep control and expansion joints free of mortar, grout, and adhesive.

K. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

L. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.

M. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.

1. Use uncoupling membrane under all tile unless other underlayment is indicated.
2. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.
3. Where epoxy bond coat and grout are indicated, install in accordance with TCNA (HB) Method F131.

3.05 INSTALLATION - FLOORS - MORTAR BED METHODS

A. Over exterior concrete substrates, install in accordance with TCNA (HB) Method F101, bonded, with standard grout.

B. Over interior concrete substrates, install in accordance with TCNA (HB) Method F111, with cleavage membrane, unless otherwise indicated.

1. Where waterproofing membrane is indicated, with standard grout or no mention of grout type, install in accordance with TCNA (HB) Method F121.
2. Where epoxy bond coat and grout are indicated, install in accordance with TCNA (HB) Method F132, bonded.

C. Waterproofing Membrane: Install as recommended by manufacturer and as specified in the section in which the product is specified.

D. Mortar Bed Thickness: 5/8 inch (15.9 mm), unless otherwise indicated.

3.06 INSTALLATION - SHOWERS AND BATHTUB WALLS

A. At tiled shower receptors install in accordance with TCNA (HB) Method B415, mortar bed floor, and W244, thin-set over cementitious backer unit walls.

B. At bathtub walls install in accordance with TCNA (HB) Method B412, over cementitious backer units with waterproofing membrane.

C. Grout with standard grout as specified above.

3.07 INSTALLATION - WALL TILE

A. On exterior walls install in accordance with TCNA (HB) Method W244, thin-set over cementitious backer units, with waterproofing membrane.

B. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms.

C. Over gypsum wallboard on wood or metal studs install in accordance with TCNA (HB) Method W243, thin-set with dry-set or latex-Portland cement bond coat, unless otherwise indicated.

1. Where mortar bed is indicated, install in accordance with TCNA (HB) Method W222, one coat method.
2. Where waterproofing membrane is indicated other than at showers and bathtub walls, install in accordance with TCNA (HB) Method W222, one coat method.

D. Over interior concrete and masonry install in accordance with TCNA (HB) Method W202, thin-set with dry-set or latex-Portland cement bond coat.

E. Over wood studs without backer install in accordance with TCNA (HB) Method W231, mortar bed, with membrane where indicated.

F. Over metal studs without backer install in accordance with TCNA (HB) Method W241, mortar bed, with membrane where indicated.

3.08 CLEANING

A. Clean tile and grout surfaces.

3.09 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

SECTION 09 3000
TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Tile for counters.

D. Tile for shower receptors.

E. Cementitious backer board as tile substrate.

F. Stone thresholds.

G. Ceramic accessories.

H. Ceramic trim.

I. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium). 2017.

B. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive 2013 (Revised).

C. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar 2012 (Revised).

D. ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation 2010 (Reaffirmed 2016).

E. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units 1999 (Reaffirmed 2016).

F. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes For Thin-Set Ceramic Tile And Dimension Stone Installation 2014.

G. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation 2014.

H. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar 2012.

I. ANSI A137.1 - American National Standard Specifications for Ceramic Tile 2012.

J. ANSI A137.2 - American National Standard Specifications for Glass Tile 2013.

K. ASTM C150/C150M - Standard Specification for Portland Cement 2018.

L. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2016, with Editorial Revision (2016).

M. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products 2017.

N. ASTM D4068 - Standard Specification for Chlorinated Polyethylene (CPE) Sheeting for Concealed Water-Containment Membrane 2017.

O. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation 2017.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories and setting details.

C. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches (457 by 457 mm) in size illustrating pattern, color variations, and grout joint size variations.

1.05 QUALITY ASSURANCE

A. Maintain one copy of and ANSI A108/A118/A136 and TCNA (HB) on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.

C. Installer Qualifications: Company specializing in performing tile installation, with minimum of five years of documented experience.

1.06 MOCK-UP

A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.

B. Construct tile mock-up where indicated on drawings, incorporating all components specified for the location.

1. Minimum size of mock-up is indicated on drawings.
2. Approved mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.

B. Maintain ambient and substrate temperature of 50 degrees F (10 degrees C) during installation of mortar materials.

PART 2 PRODUCTS

2.01 TILE

A. Manufacturers: All products by the same manufacturer.

1. Dal-Tile Corporation: www.daltile.com/#sle.
2. Terrazzo & Marble Supply Companies: www.tmsupply.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

B. Ceramic Mosaic Tile: ANSI A137.1 standard grade.

1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
2. Color(s): As indicated on drawings.
3. Trim Units: Matching bead, cove and surface bullnose shapes in sizes coordinated with field tile.

C. Glazed Wall Tile: ANSI A137.1 standard grade.

1. Moisture Absorption: 7.0 to 20.0 percent as tested in accordance with ASTM C373.
2. Color(s): To be selected by Architect from manufacturer's standard range.
3. Trim Units: Matching bead, bullnose, cove and base shapes in sizes coordinated with field tile.
4. Products:
    a. Substitutions: See Section 01 6000 - Product Requirements.

D. Quarry Tile: ANSI A137.1 standard grade.
1. Moisture Absorption: 0.5 to 3.0 percent as tested in accordance with ASTM C373.
2. Color(s): To be selected by Architect from manufacturer's standard range.
3. Trim Units: Matching bullnose, cove, cove base and window sill or step nosing shapes in sizes coordinated with field tile.
4. Products:
    a. Metropolitan Ceramics: www.metroceramics.com/#sle.
    b. Summitville Tiles, Inc: www.summitville.com/#sle.
    c. Substitutions: See Section 01 6000 - Product Requirements.

E. Porcelain Tile: ANSI A137.1 standard grade.
1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
2. Trim Units: Matching bullnose, double bullnose, cove base and cove shapes in sizes coordinated with field tile.
3. Products:
    a. Substitutions: See Section 01 6000 - Product Requirements.

F. Natural Stone Tile:
1. Products:
    a. Diamond Tech Tiles: www.dttiles.com/#sle.

G. Artificial Stone Tile:
1. Composition: 93 percent aggregate, quartz and recycled glass.
2. Products:
    a. Terrazzo & Marble Supply Companies; DIFINITI Quartz: www.tmsupply.com/#sle.
    b. Substitutions: See Section 01 6000 - Product Requirements.

H. Glass Tile: ANSI A137.2 standard grade.

I. Terrazzo Tile:
1. Composition: Portland cement, ASTM C150/C150M; aggregate complying with ASTM C33/C33M.
2. Products:
    a. Tectura Designs, a division of Wausau Tile Inc; Terrazzo Tile: www.tecturadesigns.com/#sle.
    b. Substitutions: See Section 01 6000 - Product Requirements.

2.02 TRIM AND ACCESSORIES

A. Ceramic Accessories: Glazed finish, same color and finish as adjacent field tile; same manufacturer as tile.

1. Soap Dish: With handle, clam shell design, recess mounted; cast strength sufficient to resist lateral pull force of 75 lbs (34 Kg).
2. Toilet Tissue Holder: Recessed, for single roll, with spring loaded holder.
3. Towel Bars: Standard design, surface mounted with extensions for casting into small wall openings; cast strength sufficient to resist lateral pull force of 30 lbs (14 Kg).

B. Ceramic Trim: Matching bullnose, double bullnose, cove base and cove ceramic shapes in sizes coordinated with field tile.
   1. Applications:
      a. Open Edges: Bullnose.
      b. Inside Corners: Jointed.
      c. Floor to Wall Joints: Cove base.
   2. Manufacturers: Same as for tile.

C. Non-Ceramic Trim: Satin brass anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.
   1. Applications:
      a. Open edges of wall tile.
      b. Open edges of floor tile.
      c. Wall corners, outside and inside.
      d. Transition between floor finishes of different heights.
      e. Thresholds at door openings.
      f. Expansion and control joints, floor and wall.
      g. Floor to wall joints.
      h. Borders and other trim as indicated on drawings.
      i. Balcony and terrace edge trim and fascia.
   2. Manufacturers:
      a. Schluter-Systems: www.schluter.com/#sle.
      b. Genesis APS International: www.genesis-aps.com/#sle.
      c. Substitutions: See Section 01 6000 - Product Requirements.

D. Thresholds: Marble, white or gray, honed finish; 2 inches (51 mm) wide by full width of wall or frame opening; 1/2 inch thick (12.7 mm thick); beveled one long edge with radiused corners on top side; without holes, cracks, or open seams.
   1. Applications:
      a. At doorways where tile terminates.

2.03 SETTING MATERIALS

A. Manufacturers:
   1. ARDEX Engineered Cements: www.ardexamericas.com/#sle.
   2. Bostik Inc: www.bostik-us.com/#sle.
   3. Custom Building Products: www.custombuildingproducts.com/#sle.

4. Substitutions: See Section 01 6000 - Product Requirements.

B. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.

1. Applications: Use this type of bond coat where indicated and where no other type of bond coat is indicated.

2. Products:

a. ARDEX Engineered Cements; ARDEX N 23 MICROTEC: www.ardexamericas.com/#sle.

C. Improved Latex-Portland Cement Mortar Bond Coat: ANSI A118.15.

1. Applications: Use this type of bond coat where indicated and where no other type of bond coat is indicated.

2. Products:

a. ARDEX Engineered Cements; S 28: www.ardexamericas.com/#sle.

b. Substitutions: See Section 01 6000 - Product Requirements.

D. Epoxy Adhesive and Mortar Bond Coat: ANSI A118.3.

1. Applications: Where indicated on drawings.

2. Products:

a. Custom Building Products; EBM-Lite Epoxy Bonding Mortar: www.custombuildingproducts.com/#sle.

b. LATICRETE International, Inc; LATICRETE LATAPOXY 300 Adhesive: www.laticrete.com/#sle.

c. Substitutions: See Section 01 6000 - Product Requirements.

E. Water Based Adhesive: Multi-purpose type mastic.

1. Products:

a. Stauf USA, LLC; M420 Spot Tack: www.staufusa.com/#sle.

b. Substitutions: See Section 01 6000 - Product Requirements.

F. Mortar Bed Materials: Pre-packaged mix of Portland cement, sand, latex additive, and water.

1. Products:

a. LATICRETE International, Inc; LATICRETE 3701 Fortified Mortar Bed: www.laticrete.com/#sle.

b. Substitutions: See Section 01 6000 - Product Requirements.

2.04 GROUTS

A. Manufacturers:

1. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: www.laticrete.com/#sle.

B. Standard Grout: ANSI A118.6 standard cement grout.

1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.

2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.

3. Color(s): As selected by Architect from manufacturer's full line.

4. Products:

a. Custom Building Products; Polyblend Non-Sanded Grout: www.custombuildingproducts.com/#sle.

b. LATICRETE International, Inc; LATICRETE 1500 Sanded Grout: www.laticrete.com/#sle.

c. Substitutions: See Section 01 6000 - Product Requirements.

C. Stain Resistant Grout Additive: Liquid admixture for sanded and unsanded cement-based grouts; mix with dry grout material in place of water.

1. Applications: Where indicated.

2.05 MAINTENANCE MATERIALS

A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.

1. Applications: Between tile and plumbing fixtures.

2. Color(s): As indicated on drawings.

3. Products:

a. ARDEX Engineered Cements; ARDEX SX: www.ardexamericas.com/#sle.

b. LATICRETE International, Inc; LATICRETE LATASIL: www.laticrete.com/#sle.

c. Substitutions: See Section 01 6000 - Product Requirements.

B. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.

1. Composition: Water-based colorless silicone.

2. Products:

a. Merkrete, by Parex USA, Inc; Merkrete Grout Sealer: www.merkrete.com/#sle.

b. Substitutions: See Section 01 6000 - Product Requirements.

C. Tile Sealer: Stain protection for natural stone.

1. Products:

a. Custom Building Products; Aqua Mix Enrich 'N' Seal: www.custombuildingproducts.com/#sle.

b. STONETECH, a division of LATICRETE international, Inc; STONETECH Heavy Duty Stone Sealer: www.laticrete.com/#sle.

c. Substitutions: See Section 01 6000 - Product Requirements.

D. Grout Release: Temporary, water-soluble pre-grout coating.

1. Products:

a. Custom Building Products; Aqua Mix Grout Release: www.custombuildingproducts.com/#sle.

2.06 ACCESSORY MATERIALS

A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.

1. Thickness: as designated on drawing.

2. Crack Resistance: No failure at 1/16 inch (1.6 mm) gap, minimum.

B. Waterproofing Membrane at Floors: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.

1. Crack Resistance: No failure at 1/16 inch (1.6 mm) gap, minimum; comply with ANSI A118.12.

2. Fluid or Trowel Applied Type:
    a. Products:
        1) ARDEX Engineered Cements; ARDEX 8+9: www.ardexamericas.com/#sle.
        2) LATICRETE International, Inc; LATICRETE HYDRO BAN: www.laticrete.com/#sle.
        3) Substitutions: See Section 01 6000 - Product Requirements.

C. Waterproofing Membrane at Showers and Tiled Tubs: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
    1. Fluid or Trowel Applied Type:
        a. Material: Acrylic.
        b. Products:
            1) ARDEX Engineered Cements; ARDEX 8+9: www.ardexamericas.com/#sle.
            2) Substitutions: See Section 01 6000 - Product Requirements.
    2. Peel-and-Stick Sheet Type:

D. Waterproofing Membrane Under Thick Mortar Bed at Showers and Tiled Tubs:
    1. Material: Chlorinated polyethylene sheet, 40 mils (1.0 mm) thick, minimum; complying with ASTM D4068.
    2. Products:
        a. Noble Company; Chloraloy Shower Pan Liner: www.noblecompany.com/#sle.

E. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 1/2 inch (12.7 mm) thick; 2 inch (51 mm) wide coated glass fiber tape for joints and corners.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.

3.02 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

E. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

A. Install tile, thresholds and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, manufacturer's instructions, and TCNA (HB) recommendations.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles bullnosed.

F. Install ceramic accessories rigidly in prepared openings.

G. Install non-ceramic trim in accordance with manufacturer's instructions.

H. Install thresholds where indicated.

I. Sound tile after setting. Replace hollow sounding units.

J. Keep control and expansion joints free of mortar, grout, and adhesive.

K. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

L. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.

M. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.

1. Use uncoupling membrane under all tile unless other underlayment is indicated.
2. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.
3. Where epoxy bond coat and grout are indicated, install in accordance with TCNA (HB) Method F131.

3.05 INSTALLATION - FLOORS - MORTAR BED METHODS

A. Over exterior concrete substrates, install in accordance with TCNA (HB) Method F101, bonded, with standard grout.

B. Over interior concrete substrates, install in accordance with TCNA (HB) Method F111, with cleavage membrane, unless otherwise indicated.

1. Where waterproofing membrane is indicated, with standard grout or no mention of grout type, install in accordance with TCNA (HB) Method F121.
2. Where epoxy bond coat and grout are indicated, install in accordance with TCNA (HB) Method F132, bonded.

C. Waterproofing Membrane: Install as recommended by manufacturer and as specified in the section in which the product is specified.

D. Mortar Bed Thickness: 5/8 inch (15.9 mm), unless otherwise indicated.

3.06 INSTALLATION - SHOWERS AND BATHTUB WALLS

A. At tiled shower receptors install in accordance with TCNA (HB) Method B415, mortar bed floor, and W244, thin-set over cementitious backer unit walls.

B. At bathtub walls install in accordance with TCNA (HB) Method B412, over cementitious backer units with waterproofing membrane.

C. Grout with standard grout as specified above.

3.07 INSTALLATION - WALL TILE

A. On exterior walls install in accordance with TCNA (HB) Method W244, thin-set over cementitious backer units, with waterproofing membrane.

B. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms.

C. Over gypsum wallboard on wood or metal studs install in accordance with TCNA (HB) Method W243, thin-set with dry-set or latex-Portland cement bond coat, unless otherwise indicated.

1. Where mortar bed is indicated, install in accordance with TCNA (HB) Method W222, one coat method.

2. Where waterproofing membrane is indicated other than at showers and bathtub walls, install in accordance with TCNA (HB) Method W222, one coat method.

D. Over interior concrete and masonry install in accordance with TCNA (HB) Method W202, thin-set with dry-set or latex-Portland cement bond coat.

E. Over wood studs without backer install in accordance with TCNA (HB) Method W231, mortar bed, with membrane where indicated.

F. Over metal studs without backer install in accordance with TCNA (HB) Method W241, mortar bed, with membrane where indicated.

3.08 CLEANING

A. Clean tile and grout surfaces.

3.09 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

SECTION 09 5100
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

C. Supplementary acoustical insulation above ceiling.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

1.03 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings 2017.

B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels 2013.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2018b.

D. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions 2017.

E. ASTM E1264 - Standard Classification for Acoustical Ceiling Products 2014.

F. UL (FRD) - Fire Resistance Directory Current Edition.

1.04 SUBMITTALS

A. Product Data: Provide data on suspension system components.

B. Samples: Submit two full size samples illustrating material and finish of acoustical units.

1.05 QUALITY ASSURANCE

A. Fire-Resistive Assemblies: Complete assembly listed and classified by UL (FRD) for the fire resistance indicated.

B. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver acoustical tiles, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical tiles, permit them to reach room temperature and stabilized moisture content.

C. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

1.07 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

B. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical tile ceiling installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustic Tiles/Panels:

1. Substitutions: See Section 01 6000 - Product Requirements.

B. Suspension Systems:

1. Same as for acoustical units.

2.02 ACOUSTICAL UNITS

A. General

1. Source Limitations: Obtain each type of acoustical ceiling tile and supporting suspension system from single source from single manufacturer.
2. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface according to ASTM E 795.
3. Acoustical Tile Colors and Patterns: Match appearance characteristics indicated for each product type.
4. Manufacturers:
   a. USG, model 1830

B. Acoustical Units - General: ASTM E1264, Class A.

1. Units for Installation in Fire-Rated Suspension System: Listed and classified for the fire-resistive assembly as part of suspension system.
2. VOC Content: As specified in Section 01 6116.

2.03 SUSPENSION SYSTEM(S)

A. Metal Suspension Systems:

1. General:
   a. Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings and hold down clips as required.
2. Attachment Devices
   a. Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
   b. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
      1) Type: Postinstalled bonded anchors. b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service

condition.

2) Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchors.

c. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified testing and inspecting agency.

3. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

a. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.

b. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.

4. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

5. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1-mm-) thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.

6. Seismic Struts: Manufacturer's standard compression struts designed to accommodate lateral forces.

7. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical tiles in-place.

2.04 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Perimeter Moldings: Same material and finish as grid.

1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

C. Acoustical Insulation: Specified in Section 07 2100.

1. Thickness: 2 inch (50 mm).

2. Size: To fit acoustical suspension system.

D. Gypsum Board: Fire rated type; 5/8 inch (15 mm) thick, ends and edges square, paper faced.

E. Acoustical Sealant For Perimeter Moldings: Non-hardening, non-skinning, for use in conjunction with suspended ceiling system.

2.05 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials. 2. Smoke-Developed Index: 50 or less.

B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

C. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

D. Examine acoustical tiles before installation. Reject acoustical tiles that are wet, moisture damaged, or mold damaged.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders, and comply with layout shown on reflected ceiling plans.

3.03 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M and manufacturer's instructions and as supplemented in this section.

B. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.

C. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

D. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

E. Locate system on room axis according to reflected plan.

F. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

G. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

H. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

I. Do not attach hangers to steel deck tabs.

J. Do not attach hangers to steel roof deck. Attach hangers to structural members.

K. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.

L. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

M. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

N. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

O. Support fixture loads using supplementary hangers located within 6 inches (150 mm) of each corner, or support components independently.

P. Do not eccentrically load system or induce rotation of runners.

Q. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.

1. Use longest practical lengths.
2. Overlap and rivet corners.
3. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
4. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
5. Do not use exposed fasteners, including pop rivets, on moldings and trim.

R. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.

S. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension-system flanges into kerfed edges so tile-to-tile joints are closed by double lap of material.

1. Fit adjoining tile to form flush, tight joints. Scribe and cut tile for accurate fit at borders and around penetrations through tile.
2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tile and moldings, spaced 12 inches (305 mm) o.c.
3. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.04 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:

1. Cut to fit irregular grid and perimeter edge trim.
2. Make field cut edges of same profile as factory edges.

G. Where round obstructions occur, provide preformed closures to match perimeter molding.

H. Lay acoustical insulation for a distance of 48 inches (1200 mm) either side of acoustical partitions as indicated.

I. Install hold-down clips on each panel to retain panels tight to grid system; comply with fire rating requirements.

J. Install hold-down clips on panels within 20 ft (6 m) of an exterior door.

3.05 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.06 CLEANING

A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09 5100
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

C. Supplementary acoustical insulation above ceiling.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

1.03 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings 2017.

B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels 2013.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2018b.

D. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions 2017.

E. ASTM E1264 - Standard Classification for Acoustical Ceiling Products 2014.

F. UL (FRD) - Fire Resistance Directory Current Edition.

1.04 SUBMITTALS

A. Product Data: Provide data on suspension system components.

B. Samples: Submit two full size samples illustrating material and finish of acoustical units.

1.05 QUALITY ASSURANCE

A. Fire-Resistive Assemblies: Complete assembly listed and classified by UL (FRD) for the fire resistance indicated.

B. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver acoustical tiles, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical tiles, permit them to reach room temperature and stabilized moisture content.

C. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

1.07 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

B. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical tile ceiling installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustic Tiles/Panels:

1. Substitutions: See Section 01 6000 - Product Requirements.

B. Suspension Systems:

1. Same as for acoustical units.

2.02 ACOUSTICAL UNITS

A. General

1. Source Limitations: Obtain each type of acoustical ceiling tile and supporting suspension system from single source from single manufacturer.
2. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface according to ASTM E 795.
3. Acoustical Tile Colors and Patterns: Match appearance characteristics indicated for each product type.
4. Manufacturers:
   a. USG, model 1830

B. Acoustical Units - General: ASTM E1264, Class A.

1. Units for Installation in Fire-Rated Suspension System: Listed and classified for the fire-resistive assembly as part of suspension system.
2. VOC Content: As specified in Section 01 6116.

2.03 SUSPENSION SYSTEM(S)

A. Metal Suspension Systems:

1. General:
   a. Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings and hold down clips as required.
2. Attachment Devices
   a. Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
   b. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
      1) Type: Postinstalled bonded anchors. b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service

condition.

2) Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchors.

c. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified testing and inspecting agency.

3. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

a. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.

b. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.

4. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

5. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1-mm-) thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.

6. Seismic Struts: Manufacturer's standard compression struts designed to accommodate lateral forces.

7. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical tiles in-place.

2.04 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Perimeter Moldings: Same material and finish as grid.

1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

C. Acoustical Insulation: Specified in Section 07 2100.

1. Thickness: 2 inch (50 mm).

2. Size: To fit acoustical suspension system.

D. Gypsum Board: Fire rated type; 5/8 inch (15 mm) thick, ends and edges square, paper faced.

E. Acoustical Sealant For Perimeter Moldings: Non-hardening, non-skinning, for use in conjunction with suspended ceiling system.

2.05 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials. 2. Smoke-Developed Index: 50 or less.

B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

C. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

D. Examine acoustical tiles before installation. Reject acoustical tiles that are wet, moisture damaged, or mold damaged.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders, and comply with layout shown on reflected ceiling plans.

3.03 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M and manufacturer's instructions and as supplemented in this section.

B. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.

C. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

D. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

E. Locate system on room axis according to reflected plan.

F. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

G. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

H. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

I. Do not attach hangers to steel deck tabs.

J. Do not attach hangers to steel roof deck. Attach hangers to structural members.

K. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.

L. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

M. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

N. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

O. Support fixture loads using supplementary hangers located within 6 inches (150 mm) of each corner, or support components independently.

P. Do not eccentrically load system or induce rotation of runners.

Q. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.

1. Use longest practical lengths.
2. Overlap and rivet corners.
3. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
4. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
5. Do not use exposed fasteners, including pop rivets, on moldings and trim.

R. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.

S. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension-system flanges into kerfed edges so tile-to-tile joints are closed by double lap of material.

1. Fit adjoining tile to form flush, tight joints. Scribe and cut tile for accurate fit at borders and around penetrations through tile.
2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tile and moldings, spaced 12 inches (305 mm) o.c.
3. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.04 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:

1. Cut to fit irregular grid and perimeter edge trim.
2. Make field cut edges of same profile as factory edges.

G. Where round obstructions occur, provide preformed closures to match perimeter molding.

H. Lay acoustical insulation for a distance of 48 inches (1200 mm) either side of acoustical partitions as indicated.

I. Install hold-down clips on each panel to retain panels tight to grid system; comply with fire rating requirements.

J. Install hold-down clips on panels within 20 ft (6 m) of an exterior door.

3.05 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.06 CLEANING

A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09 5114
ACOUSTICAL FABRIC-FACED PANEL CEILINGS

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PART 1 GENERAL

2.01 SECTION INCLUDES

A. Fabric-faced, fiberglass core acoustical panels.

B. Suspended metal grid ceiling system.

C. Trim and miscellaneous accessories.

2.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 03 1000 - Concrete Forms and Accessories: Placement of special anchors or inserts for suspension system.

C. Section 03 3000 - Cast-in-Place Concrete: Placement of special anchors or inserts for suspension system.

D. Section 05 3100 - Steel Decking: Placement of special anchors or inserts for suspension system.

E. Section 09 5100 - Acoustical Ceilings: Suspension system for acoustical panels specified in this section.

2.03 REFERENCE STANDARDS

A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method 2017.

B. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings 2017.

C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels 2013.

D. CISCA (AC) - Acoustical Ceilings: Use and Practice 1999.

2.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Fabric Selection Samples: Manufacturer's full range of fabric samples illustrating available colors and textures.

D. Maintenance Materials: Furnish the following for Owner 's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Acoustical Panels: 1,000 square feet (100 square meters) of each type and size.

2.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's unopened packaging and store unopened in fully enclosed space until ready for installation. Protect products from exposure to sunlight, moisture, and mechanical damage.

B. Handle acoustical panels carefully to avoid soiling exposed surfaces or damaging surfaces and edges.

2.06 FIELD CONDITIONS

A. Maintain temperature within 15 degrees Fahrenheit (8 degrees C) and relative humidity within 10 percent of design conditions for spaces of installation not less than 48 hours before installation begins and thereafter.

PART 2 PRODUCTS

3.01 ACOUSTICAL PANELS

A. Manufacturers:

1. CertainTeed Corporation; [_____]: www.certainteed.com/#sle.
2. Conwed Designscape/Wall Technology, an Owens Corning company; [_____]: www.conweddesignscape.com/#sle.
3. Hunter Douglas Contract; [_____]: www.hunterdouglascontract.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Provide panels comprising a compressible structural fiberglass core with non-woven polyester textile surface wrapped on edges; with properties as follows:

1. Panel Thickness: [___] inch ([___] mm).
2. Edge Condition: One of the following:
3. Noise Reduction Coefficient (NRC): Minimum [____], measured in accordance with ASTM C423.
    a. Provide equal or better absorption coefficient reading at the following specified frequencies:
        1) Frequency, 125 Hz; absorption coefficient, 0.54.
        2) Frequency, 250 Hz; absorption coefficient, 0.87.
        3) Frequency, 500 Hz, absorption coefficient, 0.71.
        4) Frequency, 1000 Hz, absorption coefficient, 0.82.
        5) Frequency, 2000 Hz, absorption coefficient, 0.95.
4. Sound Absorption Average: (SAA) 0.89, measured in accordance with ASTM C423.
5. Surface Burning Characteristics: Flame spread index less than 25, smoke developed index less than 100; Class A, per ASTM E84 and ASTM E1264.
6. Light Reflectance: LR-1 (0.75), measured in accordance with ASTM E1477.
7. Moisture Resistance: Resistant to relative humidity up to 95 percent at 104 degrees F (40 degrees C) for 30 days.
8. Mold and Mildew Resistance: In accordance with requirements of ASTM C665.

3.02 SUSPENSION SYSTEM

A. General: Provide system complying with ASTM C635/C635M, die cut and interlocking components, with matching perimeter moldings and other accessories as required for project conditions.

1. Materials: Formed galvanized steel, commercial quality cold rolled, intermediate duty.
2. Profile: Standard 15/16 inch (24 mm) tee shape.
3. Finish: Painted white.

B. Manufacturers:

1. Armstrong World Industries, Inc; [____]: www.armstrong.com/#sle.
2. CertainTeed Corporation; [____]: www.certainteed.com/#sle.
3. Rockfon, LLC; [____]: www.rockfon.com/#sle.
4. USG; [____]: www.usg.com/#sle.
5. Substitutions: See Section 01 6000 - Product Requirements.

C. Trim: Provide matching trim by acoustical suspension system manufacturer for conditions as follows:

1. Perimeter Trim: "L" Channel, 15/16 inch (24 mm).
2. Reveal Trim: "C" Channel, 1/8 inch (3 mm) reveal to wall.
3. Transition Trim, Straight: From drywall to acoustical panel ceiling.
4. Floating Edge Trim: Straight edge, 2-7/8 inches (73 mm) high.

D. Support Channels and Hangers: Galvanized steel, size and type to suit application.

PART 3 EXECUTION

4.01 EXAMINATION

A. Verify that layout of hangers will not interfere with other work; make adjustments in layout as necessary.

B. Do not begin ceiling installation until services above ceiling are complete except for final trim.

C. Notify Architect of unsatisfactory conditions before proceeding.

4.02 PREPARATION

A. Lay out system to a balanced grid design, with edge units not less than 50 percent of acoustical unit size.

B. Locate system on room axis according to reflected floor plan.

4.03 INSTALLATION OF SUSPENSION SYSTEM

A. Comply with requirements of CISCA (AC) - Acoustical Ceilings: Use and Practice.

B. Install in accordance with manufacturer's instructions and ASTM C636/C636M.

C. Space hangers not more than 48 inches (1220 mm) on center.

D. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

E. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

F. Support fixture loads using supplementary hangers located within 6 inches (150 mm) of each corner, or support components independently. Do not eccentrically load system or induce rotation of runners.

G. Perimeter Trim: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.

4.04 INSTALLATION OF ACOUSTICAL PANELS

A. Install acoustical panels in accordance with manufacturer's written instructions.

B. Scribe and cut panels for accurate fit at perimeter and around penetrations.

C. Hold tile field in compression when cutting. Match field cut edges with factory edges in accordance with manufacturer's instructions.

D. Install acoustical panels after above-ceiling work is complete. Install panels level, in uniform plane, and free from warp, twist, and dents.

E. Installation Tolerance: Maximum variation from flat and level surface is 1:1000.

4.05 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including suspension system and edge trim, complying with manufacturer's written instructions for cleaning of minor finish damage. Replace acoustical panels that cannot be cleaned to an appearance matching unmarred panels.

4.06 PROTECTION

A. Protect installed acoustical panel ceilings until Date of Substantial Completion.

END OF SECTION

SECTION 09 5114
ACOUSTICAL FABRIC-FACED PANEL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabric-faced, fiberglass core acoustical panels.

B. Suspended metal grid ceiling system.

C. Trim and miscellaneous accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 03 1000 - Concrete Forms and Accessories: Placement of special anchors or inserts for suspension system.

C. Section 03 3000 - Cast-in-Place Concrete: Placement of special anchors or inserts for suspension system.

D. Section 05 3100 - Steel Decking: Placement of special anchors or inserts for suspension system.

E. Section 09 5100 - Acoustical Ceilings: Suspension system for acoustical panels specified in this section.

1.03 REFERENCE STANDARDS

A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method 2017.

B. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings 2017.

C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels 2013.

D. CISCA (AC) - Acoustical Ceilings: Use and Practice 1999.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Fabric Selection Samples: Manufacturer's full range of fabric samples illustrating available colors and textures.

D. Maintenance Materials: Furnish the following for Owner 's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Acoustical Panels: 1,000 square feet (100 square meters) of each type and size.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's unopened packaging and store unopened in fully enclosed space until ready for installation. Protect products from exposure to sunlight, moisture, and mechanical damage.

B. Handle acoustical panels carefully to avoid soiling exposed surfaces or damaging surfaces and edges.

1.06 FIELD CONDITIONS

A. Maintain temperature within 15 degrees Fahrenheit (8 degrees C) and relative humidity within 10 percent of design conditions for spaces of installation not less than 48 hours before installation begins and thereafter.

PART 2 PRODUCTS

2.01 ACOUSTICAL PANELS

A. Manufacturers:

1. CertainTeed Corporation: www.certainteed.com/#sle.
2. Conwed Designscape/Wall Technology, an Owens Corning company: www.conweddesignscape.com/#sle.
3. Hunter Douglas Contract: www.hunterdouglascontract.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Provide panels comprising a compressible structural fiberglass core with non-woven polyester textile surface wrapped on edges; with properties as follows:

1. Panel Thickness: as indicated on drawings.
2. Edge Condition: One of the following:
3. Noise Reduction Coefficient (NRC): Minimum as measured in accordance with ASTM C423.
    a. Provide equal or better absorption coefficient reading at the following specified frequencies:
        1) Frequency, 125 Hz; absorption coefficient, 0.54.
        2) Frequency, 250 Hz; absorption coefficient, 0.87.
        3) Frequency, 500 Hz, absorption coefficient, 0.71.
        4) Frequency, 1000 Hz, absorption coefficient, 0.82.
        5) Frequency, 2000 Hz, absorption coefficient, 0.95.
4. Sound Absorption Average: (SAA) 0.89, measured in accordance with ASTM C423.
5. Surface Burning Characteristics: Flame spread index less than 25, smoke developed index less than 100; Class A, per ASTM E84 and ASTM E1264.
6. Light Reflectance: LR-1 (0.75), measured in accordance with ASTM E1477.
7. Moisture Resistance: Resistant to relative humidity up to 95 percent at 104 degrees F (40 degrees C) for 30 days.
8. Mold and Mildew Resistance: In accordance with requirements of ASTM C665.

2.02 SUSPENSION SYSTEM

A. General: Provide system complying with ASTM C635/C635M, die cut and interlocking components, with matching perimeter moldings and other accessories as required for project conditions.

1. Materials: Formed galvanized steel, commercial quality cold rolled, intermediate duty.
2. Profile: Standard 15/16 inch (24 mm) tee shape.
3. Finish: Painted white.

B. Manufacturers:

1. Armstrong World Industries, Inc: www.armstrong.com/#sle.

2. CertainTeed Corporation: www.certainteed.com/#sle.
3. Rockfon, LLC: www.rockfon.com/#sle.
4. USG: www.usg.com/#sle.
5. Substitutions: See Section 01 6000 - Product Requirements.

C. Trim: Provide matching trim by acoustical suspension system manufacturer for conditions as follows:
1. Perimeter Trim: "L" Channel, 15/16 inch (24 mm).
2. Reveal Trim: "C" Channel, 1/8 inch (3 mm) reveal to wall.
3. Transition Trim, Straight: From drywall to acoustical panel ceiling.
4. Floating Edge Trim: Straight edge, 2-7/8 inches (73 mm) high.

D. Support Channels and Hangers: Galvanized steel, size and type to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that layout of hangers will not interfere with other work; make adjustments in layout as necessary.

B. Do not begin ceiling installation until services above ceiling are complete except for final trim.

C. Notify Architect of unsatisfactory conditions before proceeding.

3.02 PREPARATION

A. Lay out system to a balanced grid design, with edge units not less than 50 percent of acoustical unit size.

B. Locate system on room axis according to reflected floor plan.

3.03 INSTALLATION OF SUSPENSION SYSTEM

A. Comply with requirements of CISCA (AC) - Acoustical Ceilings: Use and Practice.

B. Install in accordance with manufacturer's instructions and ASTM C636/C636M.

C. Space hangers not more than 48 inches (1220 mm) on center.

D. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

E. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

F. Support fixture loads using supplementary hangers located within 6 inches (150 mm) of each corner, or support components independently. Do not eccentrically load system or induce rotation of runners.

G. Perimeter Trim: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.

3.04 INSTALLATION OF ACOUSTICAL PANELS

A. Install acoustical panels in accordance with manufacturer's written instructions.

B. Scribe and cut panels for accurate fit at perimeter and around penetrations.

C. Hold tile field in compression when cutting. Match field cut edges with factory edges in accordance with manufacturer's instructions.

D. Install acoustical panels after above-ceiling work is complete. Install panels level, in uniform plane, and free from warp, twist, and dents.

E. Installation Tolerance: Maximum variation from flat and level surface is 1:1000.

3.05 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including suspension system and edge trim, complying with manufacturer's written instructions for cleaning of minor finish damage. Replace acoustical panels that cannot be cleaned to an appearance matching unmarred panels.

3.06 PROTECTION

A. Protect installed acoustical panel ceilings until Date of Substantial Completion.

END OF SECTION

SECTION 09 5153
DIRECT-APPLIED ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Acoustic units.

B. Perimeter trim.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

1.03 REFERENCE STANDARDS

A. ASTM E1264 - Standard Classification for Acoustical Ceiling Products 2014.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on acoustic units.

C. Shop Drawings: Indicate tile layout and related junctions with other work or ceiling finishes, interrelation of mechanical and electrical items related to system.

D. Samples: Submit two samples, in size, illustrating material and finish of acoustic units.

E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

F. Maintenance Materials: Furnish the following for Owner 's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Direct Applied Acoustical Ceilings:

1. Armstrong World Industries, Inc: www.armstrong.com/#sle.
2. CertainTeed Corporation: www.certainteed.com/#sle.
3. USG: www.usg.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Acoustic Tile: Mineral fiber, ASTM E1264 Type [_____].

B. Acoustic Tile: Open-cell melamine-based foam.

C. Adhesive: Waterproof, gun grade; type recommended by tile manufacturer.

D. Perimeter Moldings: Rolled steel profile, white color.

E. Acoustic Sealant for Perimeter Moldings: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

F. Gasket For Perimeter Moldings: Closed cell rubber sponge tape.

G. Gypsum Board: UL fire rated type; 5/8 inch (15 mm) thick, ends and edges square, paper faced.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions and substrate flatness before starting work.

3.02 INSTALLATION

A. Install system in accordance with manufacturer's instructions.

B. Perimeter Molding:

1. Install concealed edge molding at intersection of ceiling and vertical surfaces with continuous gasket.
2. Provide concealed molding at junctions with other interruptions.
3. Where curved obstructions occur, provide preformed closures to match perimeter molding.

C. Center tile on room axis leaving equal border units.

D. Fit acoustic units in place, free from damaged edges or other defects detrimental to appearance and function.

E. Install acoustic units level in uniform plane.

3.03 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).

END OF SECTION

SECTION 09 5153
DIRECT-APPLIED ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Acoustic units.

B. Perimeter trim.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

1.03 REFERENCE STANDARDS

A. ASTM E1264 - Standard Classification for Acoustical Ceiling Products 2014.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustic ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Install acoustic units after interior wet work is dry.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on acoustic units.

C. Shop Drawings: Indicate tile layout and related junctions with other work or ceiling finishes, interrelation of mechanical and electrical items related to system.

D. Samples: Submit two samples, in size, illustrating material and finish of acoustic units.

E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

F. Manufacturer's Qualification Statement.

G. Installer's Qualification Statement.

H. Maintenance Materials: Furnish the following for Owner 's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section with minimum 5 years of documented experience.

1.07 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Direct Applied Acoustical Ceilings:

1. Armstrong World Industries, Inc: www.armstrong.com/#sle.
2. CertainTeed Corporation: www.certainteed.com/#sle.
3. USG: www.usg.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Acoustic Tile: Mineral fiber, ASTM E1264 .

B. Acoustic Tile: Open-cell melamine-based foam.

C. Adhesive: Waterproof, gun grade; type recommended by tile manufacturer.

D. Perimeter Moldings: Rolled steel profile, white color.

E. Acoustic Sealant for Perimeter Moldings: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

F. Gasket For Perimeter Moldings: Closed cell rubber sponge tape.

G. Gypsum Board: UL fire rated type; 5/8 inch (15 mm) thick, ends and edges square, paper faced.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions and substrate flatness before starting work.

B. Verify that substrate conditions are ready to receive the work of this section.

3.02 INSTALLATION

A. Install system in accordance with manufacturer's instructions.

B. Perimeter Molding:

1. Install concealed edge molding at intersection of ceiling and vertical surfaces with continuous gasket.
2. Provide concealed molding at junctions with other interruptions.
3. Where curved obstructions occur, provide preformed closures to match perimeter molding.

C. Center tile on room axis leaving equal border units.

D. Fit acoustic units in place, free from damaged edges or other defects detrimental to appearance and function.

E. Install acoustic units level in uniform plane.

3.03 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).

END OF SECTION

SECTION 09 5416
LUMINOUS CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Ceiling elements and supports.

B. Luminaires and accessories.

1.02 RELATED REQUIREMENTS

A. Section 09 5100 - Acoustical Ceilings.

B. Section 09 9123 - Interior Painting.

C. Section 26 0529 - Hangers and Supports for Electrical Systems.

D. Section 26 5100 - Interior Lighting.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate layout of luminaires, support locations and details for ceiling suspension.

C. Product Data: Provide data showing ceiling component construction and finishes.

D. Ceiling Support Samples: Submit two samples of exposed ceiling support members, 12 inches (305 mm) in length, illustrating material and finish.

E. Luminous Element Samples: Submit two samples, 12 by 12 inches (305 by 305 mm) in size, illustrating material, finish, and support details.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 QUALITY ASSURANCE

A. Electrical Work: Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 MOCK-UP

A. Provide mock-up of each type of luminous ceiling system, including at least one of each component.

B. Analyze mock-up to determine illumination level and comfort achieved.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Luminous Ceilings:

1. Ceilings Plus: www.ceilingsplus.com/#sle.

2. USG: www.usg.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 LUMINOUS CEILING COMPONENTS

A. Support Grid: Concealed heavy duty, double wall steel.

B. Luminous Panels: Flat acrylic panel, 0.125 inch (3.2 mm) thick, clear, with square prismatic finish.

C. Luminous Panels: Acrylic plastic eggcrate louver, 1/2 inch (13 mm) thick with 1/2 inch (13 mm), square, straight sided cells, white finish.

D. Perimeter Treatment: Slip joint using L-shaped support member to match ceiling grid.

E. Luminaires: Specified in Section 26 5100.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that mechanical work above luminous ceiling has been completed and does not interfere with ceiling installation or performance.

3.02 PREPARATION

A. Paint surfaces and mechanical installations in cavity above luminous elements. Use 90 percent reflectance white paint applied as specified in Section 09 9123.

B. Lay out system on room axis as indicated.

C. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.

3.03 INSTALLATION

A. Locate luminaires to achieve even luminance of the ceiling luminous elements or as indicated.

B. Support luminaires independently of ceiling grid in accordance with provisions of Section 26 0529.

C. Install suspension system in accordance with ASTM C636/C636M and manufacturer's instructions and as supplemented in this section.

D. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

E. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

F. Do not eccentrically load system, or produce rotation of runners.

G. Coordinate installation of ceiling elements and supports with other Work in the vicinity.

H. Install edge molding at intersection of ceiling and vertical surfaces, using longest practical lengths. Miter corners. Provide edge moldings at junctions with other interruptions.

3.04 TOLERANCES

A. Maximum Deflection: 1/360 of span, maximum.

B. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).

C. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.05 CLEANING

A. Clean luminous ceiling elements in accordance with manufacturer's instructions.

END OF SECTION

SECTION 09 5416
LUMINOUS CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Ceiling elements and supports.

B. Luminaires and accessories.

1.02 RELATED REQUIREMENTS

A. Section 09 5100 - Acoustical Ceilings.

B. Section 09 9123 - Interior Painting.

C. Section 26 0529 - Hangers and Supports for Electrical Systems.

D. Section 26 5100 - Interior Lighting.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate layout of luminaires, support locations and details for ceiling suspension.

C. Product Data: Provide data showing ceiling component construction and finishes.

D. Ceiling Support Samples: Submit two samples of exposed ceiling support members, 12 inches (305 mm) in length, illustrating material and finish.

E. Luminous Element Samples: Submit two samples, 12 by 12 inches (305 by 305 mm) in size, illustrating material, finish, and support details.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 QUALITY ASSURANCE

A. Electrical Work: Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 MOCK-UP

A. Provide mock-up of each type of luminous ceiling system, including at least one of each component.

B. Analyze mock-up to determine illumination level and comfort achieved.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Luminous Ceilings:

1. Ceilings Plus: www.ceilingsplus.com/#sle.

2. USG: www.usg.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 LUMINOUS CEILING COMPONENTS

A. Support Grid: Concealed heavy duty, double wall steel.

B. Luminous Panels: Flat acrylic panel, 0.125 inch (3.2 mm) thick, clear, with square prismatic finish.

C. Luminous Panels: Acrylic plastic eggcrate louver, 1/2 inch (13 mm) thick with 1/2 inch (13 mm), square, straight sided cells, white finish.

D. Perimeter Treatment: Slip joint using L-shaped support member to match ceiling grid.

E. Luminaires: Specified in Section 26 5100.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that mechanical work above luminous ceiling has been completed and does not interfere with ceiling installation or performance.

3.02 PREPARATION

A. Paint surfaces and mechanical installations in cavity above luminous elements. Use 90 percent reflectance white paint applied as specified in Section 09 9123.

B. Lay out system on room axis as indicated.

C. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.

3.03 INSTALLATION

A. Locate luminaires to achieve even luminance of the ceiling luminous elements or as indicated.

B. Support luminaires independently of ceiling grid in accordance with provisions of Section 26 0529.

C. Install suspension system in accordance with ASTM C636/C636M and manufacturer's instructions and as supplemented in this section.

D. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

E. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

F. Do not eccentrically load system, or produce rotation of runners.

G. Coordinate installation of ceiling elements and supports with other Work in the vicinity.

H. Install edge molding at intersection of ceiling and vertical surfaces, using longest practical lengths. Miter corners. Provide edge moldings at junctions with other interruptions.

3.04 TOLERANCES

A. Maximum Deflection: 1/360 of span, maximum.

B. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).

C. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.05 CLEANING

A. Clean luminous ceiling elements in accordance with manufacturer's instructions.

END OF SECTION

SECTION 09 5423
LINEAR METAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Linear metal ceilings.

B. Suspended metal support system and perimeter trim.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Execution requirements for placement of attachment anchors to structure above.

B. Section 07 2100 - Thermal Insulation.

C. Section 09 2116 - Gypsum Board Assemblies: Suspension system as a substrate for this section.

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.

C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.

D. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method 2017.

E. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels 2013.

F. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions 2017.

1.04 DESIGN REQUIREMENTS

A. Design components to ensure light fixtures will not induce eccentric loads. Where components may induce rotation of ceiling system components, provide stabilizing reinforcement.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Furnish for component profiles.

C. Shop Drawings: Indicate reflected ceiling plan.

D. Samples: Submit two samples identifying size illustrating color and finish of exposed to view components.

1.06 QUALITY ASSURANCE

A. Designer Qualifications for Seismic Design: Perform under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at Maryland.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.07 MOCK-UP

A. Construct one mock-up,; include suspension system, panels, closures in mock-up.

B. Locate mock-up where directed.

C. Mock-up may remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Accept factory-finished products on site in manufacturer's unopened factory packaging only; reject opened packages.

B. Protect factory-finished products from damage to appearance by storing products in manufacturer's unopened factory packaging in dry storage area.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty; include coverage for corrosion resistance and discoloration of surface finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Linear Metal Ceilings:

1. ATAS International, Inc: www.atas.com/#sle.
2. USG: www.usg.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 LINEAR METAL CEILINGS

A. Linear Metal Ceiling System: Panels and baffles, suspension members, trim, and accessories as required to provide a complete system.

B. Performance Requirements:

1. Design to support imposed loads of indicated items without eccentric loading of supports.
2. Design for maximum deflection of 1/360 of span.
3. Noise Reduction Coefficient (NRC): [_____], measured in accordance with ASTM C423 with insulation installed.
4. Systems Located Outside Building Envelope:
    a. Thermal Resistance Value: Total R-value of [____] (RSI-value of [____]) with insulation installed.

2.03 COMPONENTS

A. Linear Metal Panels:

1. Type: Torsion spring panel; downward accessible flat panels.
    a. Size and Configuration: As indicated on drawings.
2. Type: Linear panel with reveals; snap-in installation.
    a. Size and Configuration: As indicated on drawings.
    b. Panel Profile: Channel shaped with square edges.
    c. Spacing: [1/2"] inch ([12.7] mm) reveal between panels.
3. Type: Linear panel, butt jointed; snap-in installation.
    a. Size and Configuration: As indicated on drawings.
    b. Panel Profile: Plank shaped with beveled edges.
4. Material: Stainless steel sheet, ASTM A666, Type 304.

5. Material: Aluminum sheet, ASTM B209 (ASTM B209M).

B. Linear Metal Baffles: Suspended vertically from suspension members.

C. Acoustical Backer: Manufacturer's standard non-woven fabric; as required to achieve specified acoustic performance.

D. Edge Molding, Expansion Joints, and Splices: Same material, thickness, and finish as linear panels.

E. End Caps: Formed metal; same color and finish as sight-exposed surfaces of linear panels.

F. Accessories: Stabilizer bars as required for suspended grid system; sight-exposed surfaces same color and finish as sight-exposed surfaces of linear panels.

G. Suspension Members: Formed steel sections, with integral attachment points; galvanized finish; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

H. Suspension Wire: Size and type as required for application, seismic requirements, and ceiling system flatness requirement specified.

I. Insulation: Specified in Section 07 2100.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

C. Verify that required utilities are available, in proper location, and ready for use.

D. Verify that field measurements are as indicated.

3.02 INSTALLATION

A. Suspension Components:

1. Install after above-ceiling work is complete in accordance with manufacturer's instructions, ASTM C636/C636M and ASTM E580/E580M.

2. Hang carrying members independent of walls, columns, ducts, light fixtures, pipe, and conduit; where carrying members are spliced, avoid visible displacement of face panels with adjacent panels.

3. Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest adjacent hangers to span the required distance.

B. Linear Metal Ceiling:

1. Install linear panels, baffles, and other system components in accordance with manufacturer's instructions.

2. Align end joints.

3. Butt interior end joints tight.

4. Set exterior end joints with 1/16 inch (2 mm) gap for expansion and contraction.

5. Provide expansion joints to accommodate plus or minus 1 inch (25 mm) movement and maintain visual closure.

6. Field miter corners at changes in panel direction.

7. Exercise care when site cutting sight-exposed finished components to ensure surface finish is not defaced.

C. Insulation: Install above panel members; fit tight between grid members ; place insulation with facing side down.

3.03 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).

3.04 CLEANING

A. Clean polished surfaces.

B. Replace damaged or abraded components.

END OF SECTION

SECTION 09 5423
LINEAR METAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Linear metal ceilings.

B. Suspended metal support system and perimeter trim.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Execution requirements for placement of attachment anchors to structure above.

B. Section 07 2100 - Thermal Insulation.

C. Section 09 2116 - Gypsum Board Assemblies: Suspension system as a substrate for this section.

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.

C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.

D. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method 2017.

E. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels 2013.

F. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions 2017.

1.04 DESIGN REQUIREMENTS

A. Design components to ensure light fixtures will not induce eccentric loads. Where components may induce rotation of ceiling system components, provide stabilizing reinforcement.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate work of this section with installation of mechanical and electrical components and with other construction activities affected by work of this section.

B. Preinstallation Meeting: Convene one week before starting work of this section.

C. Sequencing: Supply hanger clips during steel deck erection. Supply additional hangers and inserts as required.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Furnish for component profiles.

C. Shop Drawings: Indicate reflected ceiling plan.

D. Samples: Submit two samples identifying size illustrating color and finish of exposed to view components.

E. Manufacturer's Qualification Statement.

F. Installer's Qualification Statement.

G. Maintenance Materials: Furnish the following for Owner 's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Linear Panels: One, standard length.

1.07 QUALITY ASSURANCE

A. Designer Qualifications for Seismic Design: Perform under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at Maryland.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section.

1. Minimum 5 years documented experience.
2. Approved by metal ceiling manufacturer.

D. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc.

1.08 MOCK-UP

A. Construct one mock-up,; include suspension system, panels, closures in mock-up.

B. Locate mock-up where directed.

C. Mock-up may remain as part of the Work.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Accept factory-finished products on site in manufacturer's unopened factory packaging only; reject opened packages.

B. Protect factory-finished products from damage to appearance by storing products in manufacturer's unopened factory packaging in dry storage area.

1.10 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty; include coverage for corrosion resistance and discoloration of surface finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Linear Metal Ceilings:

1. ATAS International, Inc: www.atas.com/#sle.
2. USG: www.usg.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 LINEAR METAL CEILINGS

A. Linear Metal Ceiling System: Panels and baffles, suspension members, trim, and accessories as required to provide a complete system.

B. Performance Requirements:

1. Design to support imposed loads of indicated items without eccentric loading of supports.
2. Design for maximum deflection of 1/360 of span.
3. Noise Reduction Coefficient (NRC): measured in accordance with ASTM C423 with insulation installed.

4. Systems Located Outside Building Envelope:
    a. Thermal Resistance Value: as indicated on plans.

2.03 COMPONENTS

A. Linear Metal Panels:
    1. Type: Torsion spring panel; downward accessible flat panels.
        a. Size and Configuration: As indicated on drawings.
    2. Type: Linear panel with reveals; snap-in installation.
        a. Size and Configuration: As indicated on drawings.
        b. Panel Profile: Channel shaped with square edges.
        c. Spacing: [1/2"] inch ([12.7] mm) reveal between panels.
    3. Type: Linear panel, butt jointed; snap-in installation.
        a. Size and Configuration: As indicated on drawings.
        b. Panel Profile: Plank shaped with beveled edges.
    4. Material: Stainless steel sheet, ASTM A666, Type 304.
    5. Material: Aluminum sheet, ASTM B209 (ASTM B209M).

B. Linear Metal Baffles: Suspended vertically from suspension members.

C. Acoustical Backer: Manufacturer's standard non-woven fabric; as required to achieve specified acoustic performance.

D. Edge Molding, Expansion Joints, and Splices: Same material, thickness, and finish as linear panels.

E. End Caps: Formed metal; same color and finish as sight-exposed surfaces of linear panels.

F. Accessories: Stabilizer bars as required for suspended grid system; sight-exposed surfaces same color and finish as sight-exposed surfaces of linear panels.

G. Suspension Members: Formed steel sections, with integral attachment points; galvanized finish; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

H. Suspension Wire: Size and type as required for application, seismic requirements, and ceiling system flatness requirement specified.

I. Insulation: Specified in Section 07 2100.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

C. Verify that required utilities are available, in proper location, and ready for use.

D. Verify that field measurements are as indicated.

3.02 INSTALLATION

A. Suspension Components:
    1. Install after above-ceiling work is complete in accordance with manufacturer's instructions, ASTM C636/C636M and ASTM E580/E580M.

2. Hang carrying members independent of walls, columns, ducts, light fixtures, pipe, and conduit; where carrying members are spliced, avoid visible displacement of face panels with adjacent panels.
3. Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest adjacent hangers to span the required distance.

B. Linear Metal Ceiling:

1. Install linear panels, baffles, and other system components in accordance with manufacturer's instructions.
2. Align end joints.
3. Butt interior end joints tight.
4. Set exterior end joints with 1/16 inch (2 mm) gap for expansion and contraction.
5. Provide expansion joints to accommodate plus or minus 1 inch (25 mm) movement and maintain visual closure.
6. Field miter corners at changes in panel direction.
7. Install filler strips between linear panels at interior locations.
8. Install end caps at sight-exposed ends of linear panels.
9. Exercise care when site cutting sight-exposed finished components to ensure surface finish is not defaced.

C. Insulation: Install above panel members; fit tight between grid members ; place insulation with facing side down.

3.03 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).

3.04 CLEANING

A. Clean polished surfaces.

B. Replace damaged or abraded components.

END OF SECTION

SECTION 09 5426
SUSPENDED WOOD CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wood ceiling panels.

1.02 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Site finishing.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other ceiling finishes and mechanical and electrical items installed in the ceiling.

C. Product Data: Provide data on suspension system components and ceiling panels.

D. Test Reports: Submit substantiating engineering data, test results of previous tests by independent laboratory which purport to meet performance criteria, and other supportive data.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

1.05 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 40 degrees F (5 degrees C) during and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Suspended Wood Ceilings:

1. Acoustic Ceiling Products; Evoba Modular Wood Ceiling System: www.acpideas.com/#sle.

2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SUSPENDED WOOD CEILING SYSTEM

A. Suspension System: Solid wood construction framing with stabilizer bars, clips, splices, perimeter moldings and hold down clips as required.

1. Species: Red oak.

B. Lay-In Panels: Pre-assembled wood veneer panels, species to match suspension system.

1. Size: 24 by 24 inches (600 by 600 mm), nominal.

2. Overall Thickness: 2 inches (50 mm).

C. Trim and Corner Medallions: Solid wood construction, species to match suspension system.

D. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

E. Finish: Stained, color .

F. Performance Requirements:

1. Surface Burning Characteristics: Maximum flame spread index of 70, smoke developed index of 160, when tested in accordance with ASTM E84.

2.03 FABRICATION

A. Shop fabricate components.

B. Prepare components for mechanical and electrical openings as required and as shown on shop drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION

A. Install wall trim and corner medallions in accordance with manufacturer's installation instructions.

B. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M and manufacturer's instructions and as supplemented in this section.

C. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

D. Support ceiling grid using clips and hanger wires spaced at maximum 48 inches (1200 mm) on center.

E. Cutting Panels and Grid Components: Using a sharp, small blade saw and straight edge, mark the finish side and cut as required. Miter cut corners.

F. Install border and edge panels, then full panels working across the room.

END OF SECTION

SECTION 09 5426
SUSPENDED WOOD CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wood ceiling panels.

1.02 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Site finishing.

1.03 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings 2017.

B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels 2013.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2018b.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed.

B. Do not install ceiling until after interior wet work is dry.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other ceiling finishes and mechanical and electrical items installed in the ceiling.

C. Product Data: Provide data on suspension system components and ceiling panels.

D. Samples: Submit two full size samples illustrating material and finish of ceiling panels.

E. Test Reports: Submit substantiating engineering data, test results of previous tests by independent laboratory which purport to meet performance criteria, and other supportive data.

F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

G. Designer's Qualification Statement.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

A. Designer Qualifications for Seismic Design: Under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed at Maryland .

1.07 MOCK-UP

A. Provide mock-up including suspension members, ceiling grid trim, and ceiling panels.

B. See Section 01 4000 - Quality Requirements for additional requirements.

C. Mock-up may remain as part of the Work.

1.08 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 40 degrees F (5 degrees C) during and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Suspended Wood Ceilings:

1. Acoustic Ceiling Products; Evoba Modular Wood Ceiling System: www.acpideas.com/#sle.
2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SUSPENDED WOOD CEILING SYSTEM

A. Suspension System: Solid wood construction framing with stabilizer bars, clips, splices, perimeter moldings and hold down clips as required.

1. Species: Red oak.

B. Lay-In Panels: Pre-assembled wood veneer panels, species to match suspension system.

1. Size: 24 by 24 inches (600 by 600 mm), nominal.
2. Overall Thickness: 2 inches (50 mm).

C. Trim and Corner Medallions: Solid wood construction, species to match suspension system.

D. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

E. Finish: Stained, color .

F. Performance Requirements:

1. Surface Burning Characteristics: Maximum flame spread index of 70, smoke developed index of 160, when tested in accordance with ASTM E84.

2.03 FABRICATION

A. Shop fabricate components.

B. Prepare components for mechanical and electrical openings as required and as shown on shop drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION

A. Install wall trim and corner medallions in accordance with manufacturer's installation instructions.

B. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M and manufacturer's instructions and as supplemented in this section.

C. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

D. Locate system on room axis according to reflected ceiling plan.

E. Support ceiling grid using clips and hanger wires spaced at maximum 48 inches (1200 mm) on center.

F. Cutting Panels and Grid Components: Using a sharp, small blade saw and straight edge, mark the finish side and cut as required. Miter cut corners.

G. Install border and edge panels, then full panels working across the room.

END OF SECTION

SECTION 09 5800
INTEGRATED CEILING ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended, modular, non-fire-rated grid system.

B. Flat acoustic boards.

C. Lighting fixtures ballasts and lamps.

D. Supply air outlets.

E. Sprinkler heads.

F. Audio speakers.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 07 2100 - Thermal Insulation.

C. Section 21 1300 - Fire-Suppression Sprinkler Systems.

D. Section 23 3300 - Air Duct Accessories.

E. Section 23 3700 - Air Outlets and Inlets.

F. Section 26 0583 - Wiring Connections.

G. Section 26 5100 - Interior Lighting.

1.03 REFERENCE STANDARDS

A. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).

B. ASTM E413 - Classification for Rating Sound Insulation 2016.

C. IES RP-1 - Recommended Practice for Office Lighting 2012.

D. NFPA 13 - Standard for the Installation of Sprinkler Systems Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL (FRD) - Fire Resistance Directory Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide descriptions and characteristics of components, finishes, product limitations.

C. Shop Drawings: Indicate grid layout and dimensions, junctions with other work, relationship of mechanical and electrical items related to ceiling system, other components in the ceiling assembly.

D. Samples: Submit one acoustical board; one, 24" x48 " long piece of metal main grid, cross tee, and perimeter trim; one light fixture with ballast, lens and lamps; one each of supply devices.

1.05 QUALITY ASSURANCE

A. Grid Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.06 FIELD CONDITIONS

A. Do not install system until building is enclosed, above ceiling work is completed, tested, and approved, and dust generating activities have terminated.

B. Do not install acoustical units until after wet work has dried.

C. Maintain minimum temperature of 60 degrees F (16 degrees C) and maximum relative humidity of 50 percent, 24 hours prior to, during, and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS - ACOUSTIC PANELS

A. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MANUFACTURERS - LIGHT FIXTURES

2.03 MANUFACTURERS - LAMPS

2.04 MANUFACTURERS - AIR OUTLETS

2.05 MANUFACTURERS - FIRE SPRINKLERS

2.06 MANUFACTURERS - AUDIO SPEAKERS

2.07 REGULATORY REQUIREMENTS

2.08 INTEGRATED CEILING ASSEMBLIES

A. Integrated Ceiling Assemblies: Suspension system, panels, trim, and accessories, as indicated and as required for a complete system.

1. Provide suspension system that rigidly secures ceiling system including integral mechanical and electrical components with maximum deflection of 1/360 of span.

B. Performance Requirements:

1. Fire Rated Ceiling Assembly: UL (FRD) Assembly No. for ceiling and floor assembly, providing one hour rating.
2. System Sound Transmission Coefficient (STC): , calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
3. Acoustic Board Light Reflectance:
4. Illumination Levels: IES RP 1.
5. Air Supply: Unit capable of distributing air at maximum pressure drop and a maximum NC value of 30.
6. Return Air: Unit capable of returning air at maximum pressure drop and a maximum NC value of 30.
7. Exhaust Air: Unit capable of returning air at maximum pressure drop and a maximum NC value of 30.
8. Fire Sprinkler Design: Comply with NFPA 13.
9. Sound Masking: .

2.09 MATERIALS

A. Acoustical Panels: Complying with the following, and ASTM E1264:

1. Composition: Mineral.

2. Density: .
3. Light Reflectance:
4. NRC Range:
5. STC Range:
6. Edge: Square.
7. Surface Color: White.
8. Surface Finish: Perforated, plastic wrapped.

2.10 COMPONENTS

A. Grid Design: Modular, flat.

B. Grid Materials: Commercial quality cold rolled steel with galvanized coating.

C. Grid System: Exposed tee, ASTM C635/C635M intermediate-duty; rolled metal profiles for main and cross runners, die cut and interlocking.

D. Light Ballasts: UL 935.

E. Lamps: Manufacturers standard.

2.11 ACCESSORIES

A. Hangers: Galvanized steel wire.

B. Accessories: Structural main and cross beams, stabilizer bars, hanger clips for two, three, and four way intersections, size and type to suit application, seismic requirements.

C. Partition Support Brackets: Formed steel, designed to transfer lateral partition load to support framing above .

D. Acoustical Batt Insulation: Specified in Section 07 2100, unfaced ; 2 inch thick (; 50 mm thick).

E. Gypsum Board: Fire rated type; 5/8 inch (15 mm) thick, ends and edges square, paper faced.

F. Touch-up Paint: Type and color to match acoustical and grid units.

2.12 FINISHES

A. Grid Members: .

B. Metal Coffer Ends: .

C. Acoustic Boards: surface design, washable white surface finish.

D. Supply Air Outlets: .

E. Partition Support Brackets: Same finish as ceiling grid.

2.13 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Electrical Characteristics:

1. Refer to Section 26 0583.

B. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

PART 3 EXECUTION

3.01 INSTALLATION - GRID SYSTEM

A. Install ceiling system in accordance with manufacturers' instructions.

B. Install hangers and inserts coordinated with overhead work. Provide additional hangers and supports as required.

C. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

D. Coordinate position of hangers and carrying channels to accommodate fittings and components placed after installation of grid.

E. Where ducts or other equipment prevent regular spacing of hangers, reinforce adjacent hangers and related support members required to span the distance.

F. Install grid in accordance with reflected ceiling layout.

G. Suspend grid independently of walls, columns, ducts, pipes, and conduit. Where grid members are spliced, avoid visible displacement of face plane of adjoining members.

H. Support light fixture, supply and return air device loads with supplementary hangers located within 6 inches (150 mm) of each component corner when weight of component exceeds the system deflection limits.

I. Where component installation produces rotation or distortion of runners, provide stabilizer bars or additional support.

J. Form expansion joints to accommodate 1 inch (25 mm) movement and to maintain visual closure.

K. Install edge moldings at intersection of ceiling and vertical surfaces and penetrations, using components of maximum length, set level. Provide edge moldings at junction with other ceiling finishes. Miter corners. Provide preformed edge closures to match bullnosed cornered partitions.

3.02 INSTALLATION - COMPONENTS

A. Install air outlets with gasketed boots and collars.

B. Install light fixtures with ballasts and lamps for connection by Division 26. Install acoustic insulation over light fixtures to form an effective acoustic barrier.

C. Knock out pre-punched holes for fire sprinkler heads and install grommets.

D. Install Acoustic Units:

1. Free from damaged edges or other defects detrimental to appearance and function.
2. After above-ceiling work is complete.
3. In uniform plane, and free from twist, warp and dents.
4. Cut panels to fit irregular grid and perimeter edge trim. Field rabbet tile edge.

E. Finished Ceiling: Uniform plane, free of soiled or damaged components that are detrimental to appearance or function of system.

F. Install light fixture boxes constructed of gypsum board above light fixtures in accordance with UL assembly requirements.

G. Lay acoustical insulation for a distance of 48 inches (1,200 mm) either side of acoustical partitions as indicated.

3.03 TOLERANCES

A. Maximum Variation From Flat Plane: 1/8 inch in 10 feet (3 mm in 3 m), non-cumulative.

3.04 FIELD QUALITY CONTROL

A. An independent testing agency, as specified in Section 01 4000 - Quality Requirements, will conduct field inspection and testing.

3.05 ADJUSTING

A. Remove sags or twists in ceiling system assembly.

3.06 CLEANING

A. Clean system components after adjustment and balancing of system has been completed.

3.07 PROTECTION

A. Do not permit construction traffic through finished areas.

END OF SECTION

SECTION 09 5800
INTEGRATED CEILING ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended, modular, non-fire-rated grid system.

B. Flat acoustic boards.

C. Lighting fixtures ballasts and lamps.

D. Supply air outlets.

E. Sprinkler heads.

F. Audio speakers.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 07 2100 - Thermal Insulation.

C. Section 21 1300 - Fire-Suppression Sprinkler Systems.

D. Section 23 3300 - Air Duct Accessories.

E. Section 23 3700 - Air Outlets and Inlets.

F. Section 26 0583 - Wiring Connections.

G. Section 26 5100 - Interior Lighting.

1.03 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition 2016.

B. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).

C. ASTM E413 - Classification for Rating Sound Insulation 2016.

D. IES RP-1 - Recommended Practice for Office Lighting 2012.

E. NFPA 13 - Standard for the Installation of Sprinkler Systems Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL (FRD) - Fire Resistance Directory Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide descriptions and characteristics of components, finishes, product limitations.

C. Shop Drawings: Indicate grid layout and dimensions, junctions with other work, relationship of mechanical and electrical items related to ceiling system, other components in the ceiling assembly.

D. Samples: Submit one acoustical board; one, 24" x48 " long piece of metal main grid, cross tee, and perimeter trim; one light fixture with ballast, lens and lamps; one each of supply devices.

E. Manufacturer's Certificate: Certify that light fixtures, meet or exceed specified requirements.

F. Manufacturer's Installation Instructions: Indicate installation sequence and special cautions.

G. Installer's Qualification Statement.

H. Maintenance Materials: Furnish the following for Owner 's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Acoustic Panels: Ten.
3. Extra Sprinkler Heads: Six of each type.
4. Extra Supply Air Grilles: One.
5. Extra Return Air Grilles: One.

1.05 QUALITY ASSURANCE

A. Grid Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience and approved by manufacturer.

D. Fire Sprinkler Work: Comply with requirements of Division 21 .

1.06 MOCK-UP

A. Construct mock-up of one grid module; include at least one instance of each component of the integrated ceiling system assembly.

B. Mock-up may remain as part of the Work.

1.07 FIELD CONDITIONS

A. Do not install system until building is enclosed, above ceiling work is completed, tested, and approved, and dust generating activities have terminated.

B. Do not install acoustical units until after wet work has dried.

C. Maintain minimum temperature of 60 degrees F (16 degrees C) and maximum relative humidity of 50 percent, 24 hours prior to, during, and after installation.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Provide certificate of compliance from authorities having jurisdiction for approval of light fixtures.

2.02 INTEGRATED CEILING ASSEMBLIES

A. Integrated Ceiling Assemblies: Suspension system, panels, trim, and accessories, as indicated and as required for a complete system.

1. Provide suspension system that rigidly secures ceiling system including integral mechanical and electrical components with maximum deflection of 1/360 of span.

B. Performance Requirements:

1. Fire Rated Ceiling Assembly: UL (FRD) Assembly No. for ceiling and floor assembly, providing one hour rating.
2. System Sound Transmission Coefficient (STC): , calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
3. Acoustic Board Light Reflectance:

4. Illumination Levels: IES RP 1.
5. Air Supply: Unit capable of distributing air at maximum pressure drop and a maximum NC value of 30.
6. Return Air: Unit capable of returning air at maximum pressure drop and a maximum NC value of 30.
7. Exhaust Air: Unit capable of returning air at maximum pressure drop and a maximum NC value of 30.
8. Fire Sprinkler Design: Comply with NFPA 13.
9. Sound Masking: .

2.03 MATERIALS

A. Acoustical Panels: Complying with the following, and ASTM E1264:
   1. Composition: Mineral.
   2. Density: .
   3. Light Reflectance:
   4. NRC Range:
   5. STC Range:
   6. Edge: Square.
   7. Surface Color: White.
   8. Surface Finish: Perforated, plastic wrapped.

2.04 COMPONENTS

A. Grid Design: Modular, flat.

B. Grid Materials: Commercial quality cold rolled steel with galvanized coating.

C. Grid System: Exposed tee, ASTM C635/C635M intermediate-duty; rolled metal profiles for main and cross runners, die cut and interlocking.

D. Light Ballasts: UL 935.

E. Lamps: Manufacturers standard.

F. Supply Air Outlets: Specified in Division 23.

2.05 ACCESSORIES

A. Hangers: Galvanized steel wire.

B. Accessories: Structural main and cross beams, stabilizer bars, hanger clips for two, three, and four way intersections, size and type to suit application, seismic requirements.

C. Partition Support Brackets: Formed steel, designed to transfer lateral partition load to support framing above .

D. Acoustical Batt Insulation: Specified in Section 07 2100, unfaced ; 2 inch thick (; 50 mm thick).

E. Gypsum Board: Fire rated type; 5/8 inch (15 mm) thick, ends and edges square, paper faced.

F. Touch-up Paint: Type and color to match acoustical and grid units.

2.06 FINISHES

A. Grid Members: .

B. Metal Coffer Ends: .

C. Acoustic Boards: surface design, washable white surface finish.

D. Supply Air Outlets: .

E. Partition Support Brackets: Same finish as ceiling grid.

2.07 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Electrical Characteristics:

1. Refer to Section 26 0583.

B. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that layout of hangers will not interfere with other work.

C. Verify that required utilities are available, in proper location, and ready for use.

3.02 INSTALLATION - GRID SYSTEM

A. Install ceiling system in accordance with manufacturers' instructions.

B. Install hangers and inserts coordinated with overhead work. Provide additional hangers and supports as required.

C. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

D. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

E. Coordinate position of hangers and carrying channels to accommodate fittings and components placed after installation of grid.

F. Where ducts or other equipment prevent regular spacing of hangers, reinforce adjacent hangers and related support members required to span the distance.

G. Install grid in accordance with reflected ceiling layout.

H. Suspend grid independently of walls, columns, ducts, pipes, and conduit. Where grid members are spliced, avoid visible displacement of face plane of adjoining members.

I. Support light fixture, supply and return air device loads with supplementary hangers located within 6 inches (150 mm) of each component corner when weight of component exceeds the system deflection limits.

J. Where component installation produces rotation or distortion of runners, provide stabilizer bars or additional support.

K. Form expansion joints to accommodate 1 inch (25 mm) movement and to maintain visual closure.

L. Install edge moldings at intersection of ceiling and vertical surfaces and penetrations, using components of maximum length, set level. Provide edge moldings at junction with other ceiling finishes. Miter corners. Provide preformed edge closures to match bullnosed cornered partitions.

3.03 INSTALLATION - COMPONENTS

A. Install air outlets with gasketed boots and collars.

B. Install light fixtures with ballasts and lamps for connection by Division 26. Install acoustic insulation over light fixtures to form an effective acoustic barrier.

C. Knock out pre-punched holes for fire sprinkler heads and install grommets.

D. Install Acoustic Units:

1. Free from damaged edges or other defects detrimental to appearance and function.
2. After above-ceiling work is complete.
3. In uniform plane, and free from twist, warp and dents.
4. Cut panels to fit irregular grid and perimeter edge trim. Field rabbet tile edge.

E. Finished Ceiling: Uniform plane, free of soiled or damaged components that are detrimental to appearance or function of system.

F. Install light fixture boxes constructed of gypsum board above light fixtures in accordance with UL assembly requirements.

G. Lay acoustical insulation for a distance of 48 inches (1,200 mm) either side of acoustical partitions as indicated.

3.04 TOLERANCES

A. Maximum Variation From Flat Plane: 1/8 inch in 10 feet (3 mm in 3 m), non-cumulative.

B. Maximum Offset From True Alignment or Position: 1/8 inch (3 mm).

3.05 FIELD QUALITY CONTROL

A. An independent testing agency, as specified in Section 01 4000 - Quality Requirements, will conduct field inspection and testing.

B. Test, adjust, and balance air system in accordance with AABC (NSTSB).

3.06 ADJUSTING

A. Remove sags or twists in ceiling system assembly.

B. Replace damaged or faulty components.

3.07 CLEANING

A. Clean system components after adjustment and balancing of system has been completed.

3.08 PROTECTION

A. Do not permit construction traffic through finished areas.

END OF SECTION

SECTION 09 6340
STONE FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Stone on floors, bases, stair treads and risers.

B. Thresholds.

C. Stone setting and grouting.

1.02 RELATED REQUIREMENTS

A. Section 07 1200 - Built-Up Bituminous Waterproofing: Waterproofing membrane under mortar bed.

B. Section 07 1300 - Sheet Waterproofing: Waterproofing membrane under mortar bed.

C. Section 07 1400 - Fluid-Applied Waterproofing: Waterproofing membrane under mortar bed.

D. Section 07 9200 - Joint Sealants: Sealing joints between stone flooring work and adjacent construction and fixtures.

1.03 REFERENCE STANDARDS

A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium). 2017.

B. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive 2013 (Revised).

C. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar 2012 (Revised).

D. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation 2010 (Reaffirmed 2016).

E. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes For Thin-Set Ceramic Tile And Dimension Stone Installation 2014.

F. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation 2014.

G. ANSI A118.13 - American National Standard Specifications for Bonded Sound Reduction Membranes for Thin-Set Ceramic Tile Installation 2014.

H. ASTM C503/C503M - Standard Specification for Marble Dimension Stone 2015.

I. ASTM C568/C568M - Standard Specification for Limestone Dimension Stone 2015.

J. ASTM C615/C615M - Standard Specification for Granite Dimension Stone 2018e1.

K. ASTM C616/C616M - Standard Specification for Quartz-Based Dimension Stone 2015.

L. ASTM C629/C629M - Standard Specification for Slate Dimension Stone 2015.

M. ASTM E492 - Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine 2009, with Editorial Revision (2016).

N. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation 2017.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide instructions for using grout.

C. Shop Drawings: Indicate stone layout.

D. Samples: Mount stone and apply grout on two plywood panels, 24" x 24" in size illustrating pattern, color variations, and grout joint size variations.

E. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with TCNA (HB) instructions for methods specified.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 MOCK-UP

A. Locate where directed.

1.07 FIELD CONDITIONS

A. Maintain at least 50 degrees F (10 degrees C) ambient temperature during installation of flooring materials.

PART 2 PRODUCTS

2.01 STONE

A. Marble: Free of defects detrimental to appearance or durability; ASTM C503/C503M Classification I - Calcite:

1. Quarry: [_____]; Variety: [_____].

B. Granite: Free of defects detrimental to appearance or durability; ASTM C615/C615M.

C. Limestone: Free of defects detrimental to appearance or durability; ASTM C568/C568M Classification I - Low Density:

D. Slate: Free of defects detrimental to appearance or durability; ASTM C62 Classification II - Interior:

E. Sandstone: Free of defects detrimental to appearance or durability; ASTM C616/C616M Classification I Sandstone:

F. Base: Match flooring for surface finish and color:

G. Stair Treads and Risers: Match flooring for surface finish and color; free of defects detrimental to appearance or durability:

2.02 SETTING AND GROUTING MATERIALS

A. Provide setting and grout materials from same manufacturer.

B. Manufacturers:

1. LATICRETE International, Inc: www.laticrete.com/#sle.
2. Mapei Corporation: www.mapei.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

C. Mortar Bed Materials: Portland cement, sand, latex additive, and water.

1. Products:
   a. LATICRETE International, Inc; LATICRETE 3701 Fortified Mortar: www.laticrete.com/#sle.
   b. [_____].

c. Substitutions: See Section 01 6000 - Product Requirements.

D. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.

E. Epoxy Adhesive and Mortar Bond Coat: ANSI A118.3.

F. Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.

1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.

2. Use sanded grout for joints 1/8 inch (3 mm) wide and larger; use unsanded grout for joints less than 1/8 inch (3 mm) wide.

G. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.

1. Applications: Where indicated.

H. Stain Resistant Grout Additive: Liquid admixture for sanded and unsanded cement-based grouts; mix with dry grout material in place of water.

1. Applications: Where indicated.

2.03 ACCESSORIES

A. Cleavage Membrane: No.15 asphalt saturated felt (6.9 kg asphalt saturated felt).

B. Waterproofing Membrane at Floors: As specified in Section 07 1200.

C. Underlayment at Floors: Specifically designed for bonding to thin-set setting mortar; having the following characteristics:

1. Sound Reduction: Comply with ANSI A118.13, bonded membrane.

2. Crack Isolation: Comply with ANSI A118.12.

3. Water Resistance: Comply with ANSI A118.10, bonded waterproofing.

D. Sound Control Underlayment at Floors: Recycled rubber type, fully-adhered.

1. Sound Reduction: Comply with ASTM E492.

2. Thickness: 1/8 inch (3.2 mm), nominal.

E. Reinforcing Mesh: 2 by 2 inch (50 by 50 mm) size weave of 16/16 wire size; welded fabric, galvanized.

F. Thresholds: Same stone type as flooring, color to match, honed finish, width as indicated on drawings by full width of wall or frame opening, beveled one side, rabbeted for door stop, eased edges.

G. Cleaner: Type not harmful to stone, joint materials, or adjacent surfaces; recommended by stone producer and grout manufacturer.

H. Sealer: Colorless, slip and stain resistant type that will not detrimentally affect stone and adjacent work.

2.04 MORTAR AND GROUT MIX

A. Mix and proportion cementitious materials for site made slurry coat and mortar bed.

2.05 FABRICATION

A. Cut stone into sizes and thickness required.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive this work.

3.02 PREPARATION

A. Vacuum clean substrate surfaces; damp clean stone.

B. Clean stone prior to installation, with edges and surfaces free of dirt or foreign material.

C. Do not use wire brushes or implements that mark or damage exposed surfaces.

3.03 INSTALLATION - GENERAL

A. Lay stone units to pattern indicated, and do not interrupt pattern through openings.

B. Place thresholds at door frame openings.

C. Cut and fit stone units tightly to penetrations, leaving sealant joint space. Ensure finish trim will cover cut edges. Form corners and bases neatly. Align floor and base joints.

D. Maintain uniform joint width subject to variance in tolerance allowed in stone unit size. Make joints watertight, without voids, cracks, excess mortar or excess grout.

E. Maintain joint width of 1/4 inch (6 mm) where abutting vertical surfaces or protrusions.

F. Sound test the units after setting. Replace hollow sounding units.

G. Keep expansion and control joints free of mortar or grout. Apply sealant to joints.

H. Grout joints. Pack and work grout into voids. Neatly tool to flush surface.

3.04 MORTAR BED METHOD

A. Install in accordance with TCNA (HB) Method F111, over cleavage membrane.

B. Set stone in full mortar bed to support stone over full bearing surface.

C. Allow units to set for a minimum of 48 hours prior to grouting.

D. To accommodate joint grout, rake out joints 1/4 to 3/8 inch (6 to 10 mm).

3.05 CLEANING

A. Clean stone and grout surfaces with cleaner; seal with sealer.

END OF SECTION

SECTION 09 6340
STONE FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Stone on floors, bases, stair treads and risers.

B. Thresholds.

C. Stone setting and grouting.

1.02 RELATED REQUIREMENTS

A. Section 07 1200 - Built-Up Bituminous Waterproofing: Waterproofing membrane under mortar bed.

B. Section 07 1300 - Sheet Waterproofing: Waterproofing membrane under mortar bed.

C. Section 07 1400 - Fluid-Applied Waterproofing: Waterproofing membrane under mortar bed.

D. Section 07 9200 - Joint Sealants: Sealing joints between stone flooring work and adjacent construction and fixtures.

1.03 REFERENCE STANDARDS

A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium). 2017.

B. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive 2013 (Revised).

C. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar 2012 (Revised).

D. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation 2010 (Reaffirmed 2016).

E. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes For Thin-Set Ceramic Tile And Dimension Stone Installation 2014.

F. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation 2014.

G. ANSI A118.13 - American National Standard Specifications for Bonded Sound Reduction Membranes for Thin-Set Ceramic Tile Installation 2014.

H. ASTM C503/C503M - Standard Specification for Marble Dimension Stone 2015.

I. ASTM C568/C568M - Standard Specification for Limestone Dimension Stone 2015.

J. ASTM C615/C615M - Standard Specification for Granite Dimension Stone 2018e1.

K. ASTM C616/C616M - Standard Specification for Quartz-Based Dimension Stone 2015.

L. ASTM C629/C629M - Standard Specification for Slate Dimension Stone 2015.

M. ASTM E492 - Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine 2009, with Editorial Revision (2016).

N. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation 2017.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work of this section.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide instructions for using grout.

C. Shop Drawings: Indicate stone layout.

1. Submit stone supplier's installation instructions and field erection drawings.

D. Samples: Mount stone and apply grout on two plywood panels, 24" x 24" in size illustrating pattern, color variations, and grout joint size variations.

E. Samples: Submit sample of colored grout.

F. Samples: Submit stone samples for sealant compatibility testing.

G. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1. Include list of liquids detrimental to appearance of stone finish.

H. Maintenance Materials: Furnish the following for Owner 's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with TCNA (HB) instructions for methods specified.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.07 MOCK-UP

A. Construct mock-up, illustrating stone, finish grout, and specified accessories.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

1.08 FIELD CONDITIONS

A. Maintain at least 50 degrees F (10 degrees C) ambient temperature during installation of flooring materials.

PART 2 PRODUCTS

2.01 STONE

A. Marble: Free of defects detrimental to appearance or durability; ASTM C503/C503M Classification I - Calcite:

B. Granite: Free of defects detrimental to appearance or durability; ASTM C615/C615M.

C. Limestone: Free of defects detrimental to appearance or durability; ASTM C568/C568M Classification I - Low Density:

D. Slate: Free of defects detrimental to appearance or durability; ASTM C62 Classification II - Interior:

E. Sandstone: Free of defects detrimental to appearance or durability; ASTM C616/C616M Classification I Sandstone:

F. Base: Match flooring for surface finish and color:

G. Stair Treads and Risers: Match flooring for surface finish and color; free of defects detrimental to appearance or durability:

2.02 SETTING AND GROUTING MATERIALS

A. Provide setting and grout materials from same manufacturer.

B. Manufacturers:

1. LATICRETE International, Inc: www.laticrete.com/#sle.

2. Mapei Corporation: www.mapei.com/#sle.

3. Substitutions: See Section 01 6000 - Product Requirements.

C. Mortar Bed Materials: Portland cement, sand, latex additive, and water.

1. Products:

a. LATICRETE International, Inc; LATICRETE 3701 Fortified Mortar: www.laticrete.com/#sle.

b. Substitutions: See Section 01 6000 - Product Requirements.

D. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.

E. Epoxy Adhesive and Mortar Bond Coat: ANSI A118.3.

F. Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.

1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.

2. Use sanded grout for joints 1/8 inch (3 mm) wide and larger; use unsanded grout for joints less than 1/8 inch (3 mm) wide.

3. Color(s): As selected by Architect from manufacturer's full line.

G. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.

1. Applications: Where indicated.

H. Stain Resistant Grout Additive: Liquid admixture for sanded and unsanded cement-based grouts; mix with dry grout material in place of water.

1. Applications: Where indicated.

2.03 ACCESSORIES

A. Cleavage Membrane: No.15 asphalt saturated felt (6.9 kg asphalt saturated felt).

B. Waterproofing Membrane at Floors: As specified in Section 07 1200.

C. Underlayment at Floors: Specifically designed for bonding to thin-set setting mortar; having the following characteristics:

1. Sound Reduction: Comply with ANSI A118.13, bonded membrane.

2. Crack Isolation: Comply with ANSI A118.12.

3. Water Resistance: Comply with ANSI A118.10, bonded waterproofing.

D. Sound Control Underlayment at Floors: Recycled rubber type, fully-adhered.

1. Sound Reduction: Comply with ASTM E492.

2. Thickness: 1/8 inch (3.2 mm), nominal.

E. Reinforcing Mesh: 2 by 2 inch (50 by 50 mm) size weave of 16/16 wire size; welded fabric, galvanized.

F. Thresholds: Same stone type as flooring, color to match, honed finish, width as indicated on drawings by full width of wall or frame opening, beveled one side, rabbeted for door stop, eased edges.

G. Cleaner: Type not harmful to stone, joint materials, or adjacent surfaces; recommended by stone producer and grout manufacturer.

H. Sealer: Colorless, slip and stain resistant type that will not detrimentally affect stone and adjacent work.

2.04 MORTAR AND GROUT MIX

A. Mix and proportion cementitious materials for site made slurry coat and mortar bed.

2.05 FABRICATION

A. Cut stone into sizes and thickness required.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive this work.

3.02 PREPARATION

A. Vacuum clean substrate surfaces; damp clean stone.

B. Clean stone prior to installation, with edges and surfaces free of dirt or foreign material.

C. Do not use wire brushes or implements that mark or damage exposed surfaces.

3.03 INSTALLATION - GENERAL

A. Lay stone units to pattern indicated, and do not interrupt pattern through openings.

B. Place thresholds at door frame openings.

C. Cut and fit stone units tightly to penetrations, leaving sealant joint space. Ensure finish trim will cover cut edges. Form corners and bases neatly. Align floor and base joints.

D. Maintain uniform joint width subject to variance in tolerance allowed in stone unit size. Make joints watertight, without voids, cracks, excess mortar or excess grout.

E. Maintain joint width of 1/4 inch (6 mm) where abutting vertical surfaces or protrusions.

F. Sound test the units after setting. Replace hollow sounding units.

G. Keep expansion and control joints free of mortar or grout. Apply sealant to joints.

H. Grout joints. Pack and work grout into voids. Neatly tool to flush surface.

3.04 MORTAR BED METHOD

A. Install in accordance with TCNA (HB) Method F111, over cleavage membrane.

B. Set stone in full mortar bed to support stone over full bearing surface.

C. Allow units to set for a minimum of 48 hours prior to grouting.

D. To accommodate joint grout, rake out joints 1/4 to 3/8 inch (6 to 10 mm).

3.05 CLEANING

A. Clean stone and grout surfaces with cleaner; seal with sealer.

END OF SECTION

SECTION 09 6433
LAMINATED WOOD FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Laminated wood flooring.

B. Installation accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 06 1000 - Rough Carpentry: Wood subfloor surface.

1.03 REFERENCE STANDARDS

A. ASTM E492 - Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine 2009, with Editorial Revision (2016).

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2017.

C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride 2016a.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

PART 2 PRODUCTS

2.01 MATERIALS

A. Laminated Wood Flooring:

1. Construction: Tongue and groove, self-locking, 5-ply laminated wood planks.
2. Installation Method: Glued down.
3. Finish: Factory applied, UV cured urethane.

B. Vapor Retarder: Polyethylene sheet, 6 mil (0.152 mm) thick; 2 inch (50 mm) wide polyethylene tape for sealing joints.

C. Underlayment: 1/8 inch (3.175 mm) thick polyurethane foam.

2.02 ACCESSORIES

A. Sound Control Underlayment: Recycled rubber type.

1. Sound Reduction: Comply with ASTM E492 and ASTM E2179.
2. Products:
   a. U.S. Rubber Recycling; Quietsound Acoustical Underlayment: www.usrubber.com/#sle.
   b. Substitutions: .

B. Sound Control Underlayment: Cork and recycled rubber composite type, fully-adhered.

1. \plain\rtlch\af1\afs20\alang0\ltrch\f1\fs20\lang0\langnp0\langfe0\langfenp0 Sound Reduction: Comply with ASTM E492.
2. Thickness: 13/64 inch (5 mm), nominal.
3. Products:

a. Amorim Cork Composites S.A; RCLT500 Rubber Cork Composite Underlayment: www.amorimcorkcomposites.com/#sle.

C. Adhesives: Water-resistant; types recommended by flooring manufacturer for project substrates.

D. Divider and Edge Strip: Angle mill finish aluminum.

E. Transition Strip: Same species and finish as flooring material; profiles indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances required for type of substrate and ready to receive laminated wood flooring.

B. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of materials to substrate surface.

C. Verify that concrete sub-floor surfaces are ready for wood flooring installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are outside the following limits:

1. Moisture emission rate: Not greater than 3 lb per 1000 sq ft per 24 hours (7.1 kg per 100 sq m per 24 hours), tested according to ASTM F1869.

2. Alkalinity: pH range of 5 to 9, tested according to ASTM F710.

D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Prepare sub-floor in accordance with flooring manufacturer's installation instructions.

B. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

C. Prohibit traffic until filler is fully cured.

D. Vacuum clean substrate.

E. Apply primer to all laminated surfaces.

3.03 INSTALLATION

A. Vapor Retarder: Install loose laid, seams overlapped 4 inches (101.6 mm) and sealed with polyethylene tape. Run material 2 inches (50.8 mm) up the wall and trim after flooring is installed.

B. Underlayment: Install in accordance with manufacturer's installation instructions.

1. Install the underlayment in the same direction the flooring is to be installed.

C. Adhesives: Install in accordance with adhesive manufacturer's installation instructions.

1. Remove excess adhesive extruded through floor surface as work progresses.

D. Wood Flooring:

1. Install flooring in accordance with manufacturer's installation instructions.

2. Lay flooring in patterns indicated on drawings. Verify alignment as work progresses.

3. Arrange flooring with end matched grain set flush and tight.

4. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar; provide divider strips and transition strips in accordance with flooring manufacturer's recommendations and as indicated.

5. Install edge strips at unprotected or exposed edges, and where flooring terminates.

6. Secure edge strips before installation of flooring with stainless steel screws.
7. Install flooring under movable partitions without interrupting floor pattern.
8. Provide 1/2 inch (12.7 mm) expansion space at fixed walls and other interruptions.
9. Within two (2) hours of adhesive applied flooring installation, roll work thoroughly in both directions with 100 lb (45 kg) roller.

3.04 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damaging surfaces.

B. Clean floor surfaces in accordance with the flooring manufacturer's instructions.

3.05 PROTECTION

A. Prohibit traffic on finished floor for 24 hours after installation.

B. Place protective coverings over finished floors; do not remove coverings until after Date of Substantial Completion.

END OF SECTION

SECTION 09 6433
LAMINATED WOOD FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Laminated wood flooring.

B. Installation accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 06 1000 - Rough Carpentry: Wood subfloor surface.

1.03 REFERENCE STANDARDS

A. ASTM E492 - Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine 2009, with Editorial Revision (2016).

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2017.

C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride 2016a.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, wood species and colors available; and installation instructions.

C. Shop Drawings: Indicate floor joint pattern and termination details.

D. Samples: Submit two samples illustrating floor finish, color, and sheen.

E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Flooring Material: 10 square yards (9 sq m) matching installed flooring.
3. Extra Adhesive: Quantity necessary for installation of extra flooring material.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section.

1. Minimum three years of documented experience.
2. Approved by manufacturer.

1.06 FIELD CONDITIONS

A. Do not install wood flooring until wet construction work is complete and ambient air at installation space has moisture content stabilized at maximum moisture content of 40 percent.

B. Provide heat, light, and ventilation prior to installation.

C. Store materials in area of installation for minimum period of 24 hours prior to installation.

D. Maintain minimum room temperature of 65 degrees F (18 degrees C) and relative humidity in accordance with adhesive manufacturer's instructions for a minimum period of 48 hours prior to delivery of materials to installation space, during installation, and after installation.

PART 2 PRODUCTS

2.01 MATERIALS

A. Laminated Wood Flooring:

1. Construction: Tongue and groove, self-locking, 5-ply laminated wood planks.
2. Installation Method: Glued down.
3. Finish: Factory applied, UV cured urethane.

B. Vapor Retarder: Polyethylene sheet, 6 mil (0.152 mm) thick; 2 inch (50 mm) wide polyethylene tape for sealing joints.

C. Underlayment: 1/8 inch (3.175 mm) thick polyurethane foam.

2.02 ACCESSORIES

A. Sound Control Underlayment: Recycled rubber type.

1. Sound Reduction: Comply with ASTM E492 and ASTM E2179.
2. Products:
   a. U.S. Rubber Recycling; Quietsound Acoustical Underlayment: www.usrubber.com/#sle.
   b. Substitutions: .

B. Sound Control Underlayment: Cork and recycled rubber composite type, fully-adhered.

1. \plain\rtlch\af1\afs20\alang0\ltrch\f1\fs20\lang0\langnp0\langfe0\langfenp0 Sound Reduction: Comply with ASTM E492.
2. Thickness: 13/64 inch (5 mm), nominal.
3. Products:
   a. Amorim Cork Composites S.A; RCLT500 Rubber Cork Composite Underlayment: www.amorimcorkcomposites.com/#sle.

C. Adhesives: Water-resistant; types recommended by flooring manufacturer for project substrates.

D. Divider and Edge Strip: Angle mill finish aluminum.

E. Transition Strip: Same species and finish as flooring material; profiles indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances required for type of substrate and ready to receive laminated wood flooring.

B. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of materials to substrate surface.

C. Verify that wood sub-floors have 12 percent or less moisture content.

D. Verify that concrete sub-floor surfaces are ready for wood flooring installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are outside the following limits:

1. Moisture emission rate: Not greater than 3 lb per 1000 sq ft per 24 hours (7.1 kg per 100 sq m per 24 hours), tested according to ASTM F1869.

2. Alkalinity: pH range of 5 to 9, tested according to ASTM F710.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Prepare sub-floor in accordance with flooring manufacturer's installation instructions.

B. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

C. Prohibit traffic until filler is fully cured.

D. Vacuum clean substrate.

E. Apply primer to all laminated surfaces.

3.03 INSTALLATION

A. Vapor Retarder: Install loose laid, seams overlapped 4 inches (101.6 mm) and sealed with polyethylene tape. Run material 2 inches (50.8 mm) up the wall and trim after flooring is installed.

B. Underlayment: Install in accordance with manufacturer's installation instructions.

1. Install the underlayment in the same direction the flooring is to be installed.

C. Adhesives: Install in accordance with adhesive manufacturer's installation instructions.

1. Remove excess adhesive extruded through floor surface as work progresses.

D. Wood Flooring:

1. Install flooring in accordance with manufacturer's installation instructions.
2. Lay flooring in patterns indicated on drawings. Verify alignment as work progresses.
3. Arrange flooring with end matched grain set flush and tight.
4. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar; provide divider strips and transition strips in accordance with flooring manufacturer's recommendations and as indicated.
5. Install edge strips at unprotected or exposed edges, and where flooring terminates.
6. Secure edge strips before installation of flooring with stainless steel screws.
7. Install flooring tight to floor access covers.
8. Install flooring under movable partitions without interrupting floor pattern.
9. Provide 1/2 inch (12.7 mm) expansion space at fixed walls and other interruptions.
10. Within two (2) hours of adhesive applied flooring installation, roll work thoroughly in both directions with 100 lb (45 kg) roller.

3.04 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damaging surfaces.

B. Clean floor surfaces in accordance with the flooring manufacturer's instructions.

3.05 PROTECTION

A. Prohibit traffic on finished floor for 24 hours after installation.

B. Place protective coverings over finished floors; do not remove coverings until after Date of Substantial Completion.

END OF SECTION

SECTION 09 6466
WOOD ATHLETIC FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wood athletic flooring.

B. Subflooring.

C. Sleepers.

D. Resilient cushioning.

E. Sheet vapor retarder.

F. Floor finishes.

G. Surface finishing and game markings.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 03 3000 - Cast-in-Place Concrete: Concrete subfloor surface; recessed.

1.03 REFERENCE STANDARDS

A. MFMA (PUR) - Performance and Uniformity Rating Sport Specific Standards current edition.

B. MFMA (SPEC) - Guide Specifications for Maple Flooring Systems current edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for flooring, floor finish materials and resilient cushion.

C. Shop Drawings: Indicate floor joint pattern and termination details.

1. Indicate provisions for expansion and contraction, wall base and game insert or socket devices.

D. Maintenance Data: Include maintenance procedures and recommended maintenance materials.

E. Manufacturer's Qualification Statement.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with MFMA (SPEC).

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section.

1. Minimum three years of documented experience.

C. Installer Qualifications: Company specializing in installing products specified in this section.

1. Minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and store off the floor in a well-ventilated, weather-tight space.

1.07 FIELD CONDITIONS

A. Do not install wood flooring until wet construction work is complete and permanent heat and air conditioning is installed and operating.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Athletic Flooring:

1. Action Floor Systems; Action Anchor Flex: www.actionfloors.com/#sle.
2. Connor Sports Flooring: www.connorfloor.com/#sle.
3. Robbins Sports Surfaces: www.robbinsfloor.com/#sle.
4. Substitutions: Section 01 6000 - Product Requirements.

2.02 WOOD ATHLETIC FLOORING

A. General: Wood strip flooring, MFMA (PUR) compliant for application indicated; system components provided by single manufacturer.

B. System Description:

1. Fixed, pre-engineered subfloor anchored using channels, retainers and clips, wood strip flooring.

2.03 COMPONENTS

A. Wood Strip Flooring:

1. Species: Northern hard maple, kiln dried; tongue and groove edges, end matched.
2. Grade: First.
3. Thickness: 25/32 inch (20 mm).
4. Width: 2-1/4 inches (57 mm).

B. Sleepers:

C. Subflooring: One layer of thick plywood, APA rated, exposure 1, minimum span rating of 48/24.

D. Subflooring: Manufacturer's standard pre-engineered subfloor suitable for system indicated.

E. Resilient Cushioning: Manufacturer's standard rubber pads, factory-applied to bottom side of sleepers.

F. Vapor Retarder: Polyethylene sheet, 6 mil (0.15 mm) thick; 2 inch (50 mm) wide tape for sealing sheet seams.

G. Fasteners and Anchors: Manufacturer's standard type and size to suit application.

2.04 FINISHES

A. Floor Finishes: Types recommended by flooring manufacturer and complying with MFMA specifications.

1. Sealer: Oil based urethane.
2. Finish Coats: Oil based urethane; high gloss.

2.05 ACCESSORIES

A. Ventilating Base: Molded rubber, with a toe, pre-molded outside corners; black color.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting this work.

B. Cementitious Subfloor Surfaces: Verify that substrates are dry enough and ready for flooring installation by testing for moisture and alkalinity (pH).

1. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

C. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Prepare substrate to receive wood flooring in accordance with manufacturer's and MFMA instructions.

B. Vacuum clean substrate.

3.03 INSTALLATION

A. Place vapor retarder over concrete surface, overlap seams a minimum of 6 inches (150 mm) and seal with tape.

B. Resilient Underlayment: Install in accordance with manufacturer's instructions.

C. Sleepers with Plywood Subfloor:

1. Place sleepers at 90 degree angle to direction of finished floor; space 12 inches (300 mm) on center. Stagger end joints a minimum of 24 inches (610 mm).

2. Fasten plywood subfloor over sleepers at 45 degree angle to direction of finished floor. Allow minimum 1/4 inch (6 mm) between plywood subfloor edges.

D. Install solid blocking at doorways, under stacked bleachers, under locations of heavy equipment and as shown on drawings, in accordance with flooring manufacturer's recommendations.

E. Wood Flooring:

1. Install in accordance with manufacturer's and MFMA instructions.

2. Lay flooring parallel to length of main playing area. Blind nail or staple to subfloor.

3. Install edge strips at unprotected or exposed edges, and where flooring terminates.

4. Provide 2 inch (24 mm) expansion space at walls and other interruptions.

F. Finishing:

1. Mask off adjacent surfaces before beginning sanding.

2. Sand flooring to smooth even finish with no evidence of sander marks. Remove dust by vacuum.

3. Apply finishes in accordance with floor finish manufacturer's and MFMA instructions.

4. Apply first coat, allow to dry, then buff lightly with recommended pad to remove irregularities. Vacuum clean and wipe with damp, lint-free cloth before applying succeeding coats.

5. Apply last coat of finish.

3.04 CLEANING

A. Clean floor surfaces in accordance with floor finish manufacturer's instructions.

3.05 PROTECTION

A. Prohibit traffic on finished floor for 72 hours after installation.

B. Place protective coverings over finished floors; do not remove coverings until Date of Substantial Completion.

END OF SECTION

SECTION 09 6466
WOOD ATHLETIC FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wood athletic flooring.

B. Subflooring.

C. Sleepers.

D. Resilient cushioning.

E. Sheet vapor retarder.

F. Floor finishes.

G. Surface finishing and game markings.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 03 3000 - Cast-in-Place Concrete: Concrete subfloor surface; recessed.

C. Section 06 1000 - Rough Carpentry: Subfloor blocking.

1.03 REFERENCE STANDARDS

A. MFMA (PUR) - Performance and Uniformity Rating Sport Specific Standards current edition.

B. MFMA (SPEC) - Guide Specifications for Maple Flooring Systems current edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for flooring, floor finish materials and resilient cushion.

C. Shop Drawings: Indicate floor joint pattern and termination details.

1. Indicate provisions for expansion and contraction, wall base and game insert or socket devices.
2. Indicate location, size, design, and color of game markings.

D. Samples: Submit two samples illustrating floor finish, color, and sheen.

E. Installation Instructions: Indicate standard and special installation procedures.

F. Maintenance Data: Include maintenance procedures and recommended maintenance materials.

G. Manufacturer's Qualification Statement.

H. Installer's Qualification Statement.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Flooring Material: 10 square yards (9 sq m) matching installed flooring.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with MFMA (SPEC).

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section.

1. Minimum three years of documented experience.

C. Installer Qualifications: Company specializing in installing products specified in this section.

1. Minimum three years of documented experience.

1.06 MOCK-UP

A. Construct mock-up of wood athletic flooring including subflooring, resilient cushioning and wood flooring. Illustrate final finish and include example of painted game lines.

B. See Section 01 4000 - Quality Requirements for additional requirements.

C. Mock-up may remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and store off the floor in a well-ventilated, weather-tight space.

1.08 FIELD CONDITIONS

A. Do not install wood flooring until wet construction work is complete and permanent heat and air conditioning is installed and operating.

B. Maintain room temperature between 55 degrees F (13 degrees C) and 75 degrees F (24 degrees C) and relative humidity between 35 to 50 percent for a period of seven days prior to delivery of materials to installation space, during installation, and after installation.

C. Acclimate wood flooring materials to installation space a minimum of 48 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Athletic Flooring:

1. Action Floor Systems; Action Anchor Flex: www.actionfloors.com/#sle.
2. Connor Sports Flooring: www.connorfloor.com/#sle.
3. Robbins Sports Surfaces: www.robbinsfloor.com/#sle.
4. Substitutions: Section 01 6000 - Product Requirements.

2.02 WOOD ATHLETIC FLOORING

A. General: Wood strip flooring, MFMA (PUR) compliant for application indicated; system components provided by single manufacturer.

B. System Description:

1. Fixed, pre-engineered subfloor anchored using channels, retainers and clips, wood strip flooring.

2.03 COMPONENTS

A. Wood Strip Flooring:

1. Species: Northern hard maple, kiln dried; tongue and groove edges, end matched.
2. Grade: First.
3. Thickness: 25/32 inch (20 mm).
4. Width: 2-1/4 inches (57 mm).

B. Sleepers:

C. Subflooring: One layer of thick plywood, APA rated, exposure 1, minimum span rating of 48/24.

D. Subflooring: Manufacturer's standard pre-engineered subfloor suitable for system indicated.

E. Resilient Cushioning: Manufacturer's standard rubber pads, factory-applied to bottom side of sleepers.

F. Vapor Retarder: Polyethylene sheet, 6 mil (0.15 mm) thick; 2 inch (50 mm) wide tape for sealing sheet seams.

G. Fasteners and Anchors: Manufacturer's standard type and size to suit application.

2.04 FINISHES

A. Floor Finishes: Types recommended by flooring manufacturer and complying with MFMA specifications.

1. Sealer: Oil based urethane.

2. Finish Coats: Oil based urethane; high gloss.

2.05 ACCESSORIES

A. Ventilating Base: Molded rubber, with a toe, pre-molded outside corners; black color.

B. Adhesives: Types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting this work.

B. Cementitious Subfloor Surfaces: Verify that substrates are dry enough and ready for flooring installation by testing for moisture and alkalinity (pH).

1. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

C. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Prepare substrate to receive wood flooring in accordance with manufacturer's and MFMA instructions.

B. Vacuum clean substrate.

3.03 INSTALLATION

A. Place vapor retarder over concrete surface, overlap seams a minimum of 6 inches (150 mm) and seal with tape.

B. Resilient Underlayment: Install in accordance with manufacturer's instructions.

C. Sleepers with Plywood Subfloor:

1. Place sleepers at 90 degree angle to direction of finished floor; space 12 inches (300 mm) on center. Stagger end joints a minimum of 24 inches (610 mm).

2. Fasten plywood subfloor over sleepers at 45 degree angle to direction of finished floor. Allow minimum 1/4 inch (6 mm) between plywood subfloor edges.

D. Install solid blocking at doorways, under stacked bleachers, under locations of heavy equipment and as shown on drawings, in accordance with flooring manufacturer's recommendations.

E. Wood Flooring:

1. Install in accordance with manufacturer's and MFMA instructions.

2. Lay flooring parallel to length of main playing area. Blind nail or staple to subfloor.

3. Install edge strips at unprotected or exposed edges, and where flooring terminates.

4. Provide 2 inch (24 mm) expansion space at walls and other interruptions.

F. Finishing:

1. Mask off adjacent surfaces before beginning sanding.
2. Sand flooring to smooth even finish with no evidence of sander marks. Remove dust by vacuum.
3. Apply finishes in accordance with floor finish manufacturer's and MFMA instructions.
4. Apply first coat, allow to dry, then buff lightly with recommended pad to remove irregularities. Vacuum clean and wipe with damp, lint-free cloth before applying succeeding coats.
5. Apply last coat of finish.

3.04 CLEANING

A. Clean floor surfaces in accordance with floor finish manufacturer's instructions.

3.05 PROTECTION

A. Prohibit traffic on finished floor for 72 hours after installation.

B. Place protective coverings over finished floors; do not remove coverings until Date of Substantial Completion.

END OF SECTION

SECTION 09 6519
RESILIENT TILE FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient tile flooring.

B. Installation accessories:

1. Adhesives.
2. Finishes and cleaners.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: SCS FloorScore certification documentation.

B. Section 01 7419 - Construction Waste Management and Disposal.

C. Section 07 9200 - Joint Sealants.

D. Section 07 9513 - Expansion Joint Cover Assemblies.

1.03 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens) 2016a.

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2017.

C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride 2016a.

D. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes 2017.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings.

C. Manufacturer's documentation for flooring and accessories:

1. Technical Data.
2. Installation and Maintenance.
3. Warranty.
4. Reclamation Program.
5. Safety Data Sheets (SDS) for accessories.

D. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

E. Verification Samples: Submit two samples, 4 by 4 inch (100 by 100 mm) in size illustrating color and pattern for each resilient flooring product specified.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and that the material is of the correct style, color, quantity and run number(s).

B. Store all materials flat and off of the floor in an acclimatized, weather-tight space between 65 to 85 degrees F (18 to 29 degrees C).

C. Do not double stack pallets.

1.06 FIELD CONDITIONS

A. Acclimate material at jobsite between 65 to 85 degrees F (18 to 29 degrees C) and 35 percent to 85 percent relative humidity for 48 hours prior to installation. Temperature and relative humidity should also be maintained at the same levels during installation, and after installation.

B. Spread unopened cartons no more than 6 cartons high and at least 4 inches (101 mm) apart.

C. Keep away from heating and cooling ducts and direct sunlight.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

B. Installer Qualifications: Aspecta® Five should only be installed by professional flooring contractors that have demonstrated successful installations of jobs in similar size and scope.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Aspecta® Five Warranty - 25-Year Limited Non-Prorated Commercial Material Warranty. Coverage includes:

1. 100 percent cost of material for the entire duration of warranty (25 Years).
2. Pro-rated cost of labor (fair-market value) for the first 10 Years.
3. One-time transferability of warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Metroflor Corporation; Aspecta Five LVT: www.aspectaflooring.com/#sle.

2.02 RESILIENT TILE FLOORING

A. Luxury Vinyl Plank and Tile:

1. Physical Properties:
    a. Construction: Phthalate-free solid plank and tile made from 100 percent virgin vinyl.
2. Manufacturing, Performance, and Safety Standards:
    a. VOC Content Limits: As specified in Section 01 6116.

2.03 ACCESSORIES

A. Moldings, Transition and Edge Strips: Same material as flooring.

B. Adhesives:

1. VOC Content Limits: As specified in Section 01 6116.
2. Products:
    a. Metroflor Corporation; Prevail® 3100 Acrylic Spray Adhesive.
    b. Substitutions: See Section 01 6000 - Product Requirements.

C. Finishes and Cleaners:

1. VOC Content Limits: As specified in Section 01 6116.
2. Products:
    a. Metroflor Corporation; Prevail® Matte Finish.
    b. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION - SEE ALSO SECTION 01 7000.

A. Install flooring and accessories after other operations (including painting) have been completed.

B. Acceptance of Conditions: Carefully examine all installation areas with installer/applicator present, for compliance with requirements affecting work performance.

1. Verify that field measurements, product, adhesives, substrates, surfaces, structural support, tolerances, levelness, temperature, humidity, moisture content level, pH, cleanliness and other conditions are as required by the manufacturer, and ready to receive work.

C. Verify that substrate is contaminant-free, including old adhesives and abatement chemicals.

D. Test substrates as required by manufacturer to verify proper conditions exist.

1. Concrete:
    a. Check for concrete additives such as fly ash, curing compounds, hardeners, or other surface treatments that may prevent proper bonding of floor coverings.
    b. Moisture testing: Perform either the In-Situ Relative Humidity (RH) test (ASTM F2170) or Moisture Vapor Emission Rate (MVER) test (ASTM F1869). Refer to the Manufacturer's Installation Guide/Manual for the maximum allowable substrate moisture content. Substrates above the maximum allowable moisture content will require a moisture mitigation system.
    c. Perform alkalinity testing per ASTM F710 to verify pH level is between 7 to 10.
    d. Check substrate for absorbency per manufacturer's recommendations.
    e. Perform bond testing per ASTM F710 to determine compatibility of adhesive to concrete substrate.
2. Wood:
    a. Shall be dry, clean, structurally sound and installed per underlayment manufacturer’s installation instructions.
    b. Test wood subfloors and underlayment panels using a suitable wood moisture pin-meter. Readings between the subfloor and underlayment panels should be within 3 percent prior to installing the underlayment panels.
    c. The maximum moisture content is 14 percent.
    d. Proceed with installation only after satisfactory conditions have been met.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Prior to installation, the flooring installer should plan and attend an on-site construction meeting with the General Contractor, Architect and Property Owner to review all requirements and inspect site conditions as outlined in the manufacturer's installation document, as well as to review the requirements of ASTM F710 and any relevant building codes, or local, state, or national regulations.

B. Flooring installation should not begin until all site conditions have been assessed, testing has been completed and subfloor conditions have been approved.

C. Prepare per manufacturer's written instructions, Section 01 7000, and as follows:

1. Prepare substrates to ensure proper adhesion of Luxury Vinyl Plank & Tile.

2. Concrete Substrates: Prepare substrate per ASTM F710.

a. Verify that subfloor is clean, flat, smooth, free of dirt, rust, paint, oil, wax or any contaminant that will interfere with adhesive bonding.

b. Mechanically remove substrate coatings that are not compatible with adhesives, such as sealers, curing, hardening or parting compounds, soap, wax, oil, etc.

1) Do not use solvents or adhesive removers.

c. Expansion joints, isolation joints, or other moving joints must be honored and must not be filled with underlayment products or other materials, and floor coverings must not be laid over them. Expansion joint covering systems should be detailed by the architect or engineer, and based upon intended usage and aesthetic considerations.

d. Surface cracks, grooves, depressions, control joints or other non-moving joints, and other irregularities shall be filled or smoothed with high-quality Portland cement or calcium aluminate based patching or underlayment compound for filling or smoothing, or both.

1) Do not skim-coat large areas with patching compound, especially slick power-troweled surfaces.

2) Sand smooth per manufacturer's instructions.

e. Slick surfaces such as power-troweled concrete shall be profiled as needed to allow for a mechanical bond between the adhesive and subfloor.

f. Do not use gypsum-based underlayment products and do not skim coat concrete subfloors.

g. Self-Leveling Underlayments: Provide a dry and smoothly-sanded underlayment substrate ready for installation of Luxury Vinyl Plank & Tile. Underlayment compound shall be moisture-resistant, mildew-resistant, and alkali-resistant and must have a minimum of 3,000 psi compressive strength per ASTM C109/C109M.

h. Lightweight concrete shall have a compressive strength greater than 90 pounds per cubic foot with minimum compression strength of 2,500 psi or greater.

3. Wood Substrates or Panel Type Underlayment:

a. Wood subfloors require an underlayment (double layer construction) with a minimum total thickness of 1 inch (25 mm) and minimum of 18 inches (457 mm) of well ventilated space beneath.

1) Crawl spaces shall be insulated and protected by a vapor barrier.

b. Use minimum 0.25 inch (6 mm) thick APA-rated underlayment grade plywood with a fully sanded face or other underlayment panel that is appropriate for the intended usage. Install and prepare panels and seams according to the manufacturer's instructions.

4. Existing and Other Substrates:

a. Refer to manufacturer's professional installation guide and/or contact manufacturer, as special conditions may exist.

3.03 INSTALLATION

A. Installation per manufacturer's written instructions, Section 01 7000, and as follows:
   1. Layout shall be specified by Architect, Designer or End User.
   2. Follow layout and ensure installation reference lines are square.
   3. Field tiles shall be installed with directional arrows on back aligned in the same direction, or may be installed in quarter-turned fashion.
   4. Check cartons for and do not mix dye lots.
   5. Expansion Joints: Locate expansion, isolation, and other moving joints prior to installation.
      a. Do not fill expansion, isolation, and other moving joints with patching compound nor cover with resilient flooring.
      b. Install movement joint systems per manufacturer's instructions and per Section 07 9200 and Section 07 9513.
   6. Adhesives: Adhere flooring to substrate using the full spread method resulting in a completed installation without gaps, voids, raised edges, bubbles or any other surface imperfections.
      a. Select appropriate adhesive, trowel and follow manufacturer's instructions.
      b. Periodically spot-check transfer of adhesive to back of tile during installation.
      c. Roll floor with a 100 pound roller to ensure proper transfer of adhesive and bonding.
      d. Protect floor from traffic per manufacturer's instructions.
      e. Do not wet mop floor until the adhesive has properly set per written instructions.

3.04 FIELD QUALTITY CONTROL

A. Site tests and inspections per Section 01 4000 and as follows:
   1. Inspect flooring installation for non-conforming work including (but not limited to) the following:
      a. Lack of adhesion.
      b. Bubbles, loose tiles or raised edges.
      c. Dirt and debris underneath flooring.
      d. Excessive gaps.
      e. Improper substrate preparation (as indicated by telegraphing).
      f. Damage to tiles, including: dents/indentations, cuts, cracks, burns or punctures.

B. Non-conforming work per General Conditions and as follows:
   1. Repair or replace damaged material if not acceptable to the Architect.

3.05 CLEANING

A. Waste Management per Section 01 7000 and Section 01 7419, and as follows:
   1. Coordinate material reclamation program with manufacturer, if applicable.
      a. Store and return cartons and pallets to manufacturer or recycler for reuse or recycling.

B. Provide progress cleaning per manufacturer's written instructions, Section 01 7000, and as follows:
   1. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the work.
      a. Clean and protect completed construction until Date of Substantial Completion.

b. During installation, remove wet adhesive from surface of flooring per manufacturer's instructions.

2. Site: Maintain project site free of waste materials and debris.

C. Provide final cleaning immediately prior to Date of Substantial Completion inspection per manufacturer's written instructions and Section 01 7000.

1. Protection: Remove manufacturer's and other installed protection immediately prior to Date of Substantial Completion inspection, unless required otherwise.

2. Clean floor with a neutral 6-8 pH cleaner.

3.06 MAINTENANCE

A. Initial maintenance per flooring manufacturer’s written instructions and as follows:

1. Allow the adhesive to cure for at least 48 hours prior to wet cleaning the floor.

2. Sweep, dust mop or vacuum the floor thoroughly to remove all loose dirt, dust, grit and debris. Do not use vacuums with a beater bar assembly.

3. Remove any dried adhesive residue from the surface with mineral spirits applied to a clean, lint-free cloth.

4. Damp mop the floor using a cleaner recommended by the flooring manufacturer.

5. If necessary, scrub the floor using an auto scrubber or rotary machine (300 rpm or less) with a cleaner recommended by the flooring manufacturer. Maintain the proper dilution ratio and use the appropriate scrubbing brush or pad.

6. Thoroughly rinse the entire floor with fresh, clean water. Remove the dirty residue with a wet-vacuum or clean mop and allow the floor to dry completely.

3.07 PROTECTION

A. Protect materials from construction operations until Date of Substantial Completion or Owner occupancy, whichever occurs first.

1. Protect finished floor from abuse and damage by using heavy non-staining kraft paper, drop cloths or equivalent. Use additional, non-damaging protective materials as needed.

2. Light foot traffic on a newly installed floor can be permitted after 24 hours.

3. Keep heavy traffic and rolling loads off the newly installed LVT flooring for 48 hours.

4. Protect the floor from rolling loads by covering with protective boards.

END OF SECTION

SECTION 09 6519
RESILIENT TILE FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient tile flooring.

B. Installation accessories:

1. Adhesives.
2. Finishes and cleaners.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: SCS FloorScore certification documentation.

B. Section 01 7419 - Construction Waste Management and Disposal.

C. Section 07 9200 - Joint Sealants.

D. Section 07 9513 - Expansion Joint Cover Assemblies.

1.03 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens) 2016a.

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2017.

C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride 2016a.

D. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes 2017.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings.

C. Manufacturer's documentation for flooring and accessories:

1. Technical Data.
2. Installation and Maintenance.
3. Warranty.
4. Reclamation Program.
5. Safety Data Sheets (SDS) for accessories.

D. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

E. Verification Samples: Submit two samples, 4 by 4 inch (100 by 100 mm) in size illustrating color and pattern for each resilient flooring product specified.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and that the material is of the correct style, color, quantity and run number(s).

B. Store all materials flat and off of the floor in an acclimatized, weather-tight space between 65 to 85 degrees F (18 to 29 degrees C).

C. Do not double stack pallets.

1.06 FIELD CONDITIONS

A. Acclimate material at jobsite between 65 to 85 degrees F (18 to 29 degrees C) and 35 percent to 85 percent relative humidity for 48 hours prior to installation. Temperature and relative humidity should also be maintained at the same levels during installation, and after installation.

B. Spread unopened cartons no more than 6 cartons high and at least 4 inches (101 mm) apart.

C. Keep away from heating and cooling ducts and direct sunlight.

D. If permanent HVAC is not operational, temporary means should be used to maintain the recommended temperature and relative humidity levels.

E. Close areas to traffic during installation of flooring and accessories.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

B. Installer Qualifications: Aspecta® Five should only be installed by professional flooring contractors that have demonstrated successful installations of jobs in similar size and scope.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Aspecta® Five Warranty - 25-Year Limited Non-Prorated Commercial Material Warranty. Coverage includes:

1. 100 percent cost of material for the entire duration of warranty (25 Years).
2. Pro-rated cost of labor (fair-market value) for the first 10 Years.
3. One-time transferability of warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Metroflor Corporation; Aspecta Five LVT: www.aspectaflooring.com/#sle.

B. Substitutions: See Section 01 6000 - Product Requirements.

2.02 RESILIENT TILE FLOORING

A. Luxury Vinyl Plank and Tile:

1. Physical Properties:
    a. Construction: Phthalate-free solid plank and tile made from 100 percent virgin vinyl.
2. Manufacturing, Performance, and Safety Standards:
    a. VOC Content Limits: As specified in Section 01 6116.

2.03 ACCESSORIES

A. Moldings, Transition and Edge Strips: Same material as flooring.

B. Adhesives:

1. VOC Content Limits: As specified in Section 01 6116.

2. Products:
    a. Metroflor Corporation; Prevail® 3100 Acrylic Spray Adhesive.
    b. Substitutions: See Section 01 6000 - Product Requirements.

C. Finishes and Cleaners:
1. VOC Content Limits: As specified in Section 01 6116.
2. Products:
    a. Metroflor Corporation; Prevail® Matte Finish.
    b. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION - SEE ALSO SECTION 01 7000.

A. Install flooring and accessories after other operations (including painting) have been completed.

B. Acceptance of Conditions: Carefully examine all installation areas with installer/applicator present, for compliance with requirements affecting work performance.
1. Verify that field measurements, product, adhesives, substrates, surfaces, structural support, tolerances, levelness, temperature, humidity, moisture content level, pH, cleanliness and other conditions are as required by the manufacturer, and ready to receive work.

C. Verify that substrate is contaminant-free, including old adhesives and abatement chemicals.

D. Test substrates as required by manufacturer to verify proper conditions exist.
1. Concrete:
    a. Check for concrete additives such as fly ash, curing compounds, hardeners, or other surface treatments that may prevent proper bonding of floor coverings.
    b. Moisture testing: Perform either the In-Situ Relative Humidity (RH) test (ASTM F2170) or Moisture Vapor Emission Rate (MVER) test (ASTM F1869). Refer to the Manufacturer's Installation Guide/Manual for the maximum allowable substrate moisture content. Substrates above the maximum allowable moisture content will require a moisture mitigation system.
    c. Perform alkalinity testing per ASTM F710 to verify pH level is between 7 to 10.
    d. Check substrate for absorbency per manufacturer's recommendations.
    e. Perform bond testing per ASTM F710 to determine compatibility of adhesive to concrete substrate.
2. Wood:
    a. Shall be dry, clean, structurally sound and installed per underlayment manufacturer’s installation instructions.
    b. Test wood subfloors and underlayment panels using a suitable wood moisture pin-meter. Readings between the subfloor and underlayment panels should be within 3 percent prior to installing the underlayment panels.
    c. The maximum moisture content is 14 percent.
    d. Proceed with installation only after satisfactory conditions have been met.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Prior to installation, the flooring installer should plan and attend an on-site construction meeting with the General Contractor, Architect and Property Owner to review all requirements and inspect site conditions as outlined in the manufacturer's installation document, as well as to review the requirements of ASTM F710 and any relevant building codes, or local, state, or national regulations.

B. Flooring installation should not begin until all site conditions have been assessed, testing has been completed and subfloor conditions have been approved.

C. Prepare per manufacturer's written instructions, Section 01 7000, and as follows:

1. Prepare substrates to ensure proper adhesion of Luxury Vinyl Plank & Tile.
2. Concrete Substrates: Prepare substrate per ASTM F710.
    a. Verify that subfloor is clean, flat, smooth, free of dirt, rust, paint, oil, wax or any contaminant that will interfere with adhesive bonding.
    b. Mechanically remove substrate coatings that are not compatible with adhesives, such as sealers, curing, hardening or parting compounds, soap, wax, oil, etc.
        1) Do not use solvents or adhesive removers.
    c. Expansion joints, isolation joints, or other moving joints must be honored and must not be filled with underlayment products or other materials, and floor coverings must not be laid over them. Expansion joint covering systems should be detailed by the architect or engineer, and based upon intended usage and aesthetic considerations.
    d. Surface cracks, grooves, depressions, control joints or other non-moving joints, and other irregularities shall be filled or smoothed with high-quality Portland cement or calcium aluminate based patching or underlayment compound for filling or smoothing, or both.
        1) Do not skim-coat large areas with patching compound, especially slick power-troweled surfaces.
        2) Sand smooth per manufacturer's instructions.
    e. Slick surfaces such as power-troweled concrete shall be profiled as needed to allow for a mechanical bond between the adhesive and subfloor.
    f. Do not use gypsum-based underlayment products and do not skim coat concrete subfloors.
    g. Self-Leveling Underlayments: Provide a dry and smoothly-sanded underlayment substrate ready for installation of Luxury Vinyl Plank & Tile. Underlayment compound shall be moisture-resistant, mildew-resistant, and alkali-resistant and must have a minimum of 3,000 psi compressive strength per ASTM C109/C109M.
    h. Lightweight concrete shall have a compressive strength greater than 90 pounds per cubic foot with minimum compression strength of 2,500 psi or greater.
3. Wood Substrates or Panel Type Underlayment:
    a. Wood subfloors require an underlayment (double layer construction) with a minimum total thickness of 1 inch (25 mm) and minimum of 18 inches (457 mm) of well ventilated space beneath.
        1) Crawl spaces shall be insulated and protected by a vapor barrier.
    b. Use minimum 0.25 inch (6 mm) thick APA-rated underlayment grade plywood with a fully sanded face or other underlayment panel that is appropriate for the intended usage. Install and prepare panels and seams according to the manufacturer's instructions.
4. Existing and Other Substrates:

a. Refer to manufacturer's professional installation guide and/or contact manufacturer, as special conditions may exist.

3.03 INSTALLATION

A. Installation per manufacturer's written instructions, Section 01 7000, and as follows:

1. Layout shall be specified by Architect, Designer or End User.
2. Follow layout and ensure installation reference lines are square.
3. Field tiles shall be installed with directional arrows on back aligned in the same direction, or may be installed in quarter-turned fashion.
4. Check cartons for and do not mix dye lots.
5. Expansion Joints: Locate expansion, isolation, and other moving joints prior to installation.
   a. Do not fill expansion, isolation, and other moving joints with patching compound nor cover with resilient flooring.
   b. Install movement joint systems per manufacturer's instructions and per Section 07 9200 and Section 07 9513.
6. Adhesives: Adhere flooring to substrate using the full spread method resulting in a completed installation without gaps, voids, raised edges, bubbles or any other surface imperfections.
   a. Select appropriate adhesive, trowel and follow manufacturer's instructions.
   b. Periodically spot-check transfer of adhesive to back of tile during installation.
   c. Roll floor with a 100 pound roller to ensure proper transfer of adhesive and bonding.
   d. Protect floor from traffic per manufacturer's instructions.
   e. Do not wet mop floor until the adhesive has properly set per written instructions.

3.04 FIELD QUALTITY CONTROL

A. Site tests and inspections per Section 01 4000 and as follows:

1. Inspect flooring installation for non-conforming work including (but not limited to) the following:
   a. Lack of adhesion.
   b. Bubbles, loose tiles or raised edges.
   c. Dirt and debris underneath flooring.
   d. Excessive gaps.
   e. Improper substrate preparation (as indicated by telegraphing).
   f. Damage to tiles, including: dents/indentations, cuts, cracks, burns or punctures.

B. Non-conforming work per General Conditions and as follows:

1. Repair or replace damaged material if not acceptable to the Architect.

3.05 CLEANING

A. Waste Management per Section 01 7000 and Section 01 7419, and as follows:

1. Coordinate material reclamation program with manufacturer, if applicable.
   a. Store and return cartons and pallets to manufacturer or recycler for reuse or recycling.

B. Provide progress cleaning per manufacturer's written instructions, Section 01 7000, and as follows:

1. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the work.
    a. Clean and protect completed construction until Date of Substantial Completion.
    b. During installation, remove wet adhesive from surface of flooring per manufacturer's instructions.
2. Site: Maintain project site free of waste materials and debris.

C. Provide final cleaning immediately prior to Date of Substantial Completion inspection per manufacturer's written instructions and Section 01 7000.
1. Protection: Remove manufacturer's and other installed protection immediately prior to Date of Substantial Completion inspection, unless required otherwise.
2. Clean floor with a neutral 6-8 pH cleaner.

3.06 MAINTENANCE

A. Initial maintenance per flooring manufacturer’s written instructions and as follows:
1. Allow the adhesive to cure for at least 48 hours prior to wet cleaning the floor.
2. Sweep, dust mop or vacuum the floor thoroughly to remove all loose dirt, dust, grit and debris. Do not use vacuums with a beater bar assembly.
3. Remove any dried adhesive residue from the surface with mineral spirits applied to a clean, lint-free cloth.
4. Damp mop the floor using a cleaner recommended by the flooring manufacturer.
5. If necessary, scrub the floor using an auto scrubber or rotary machine (300 rpm or less) with a cleaner recommended by the flooring manufacturer. Maintain the proper dilution ratio and use the appropriate scrubbing brush or pad.
6. Thoroughly rinse the entire floor with fresh, clean water. Remove the dirty residue with a wet-vacuum or clean mop and allow the floor to dry completely.

3.07 PROTECTION

A. Protect materials from construction operations until Date of Substantial Completion or Owner occupancy, whichever occurs first.
1. Protect finished floor from abuse and damage by using heavy non-staining kraft paper, drop cloths or equivalent. Use additional, non-damaging protective materials as needed.
2. Light foot traffic on a newly installed floor can be permitted after 24 hours.
3. Keep heavy traffic and rolling loads off the newly installed LVT flooring for 48 hours.
4. Protect the floor from rolling loads by covering with protective boards.

END OF SECTION

SECTION 09 6566
RESILIENT ATHLETIC FLOORING

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PART 1 GENERAL

2.01 SECTION INCLUDES

A. Rubber sheet flooring, adhesively installed.

B. Vinyl sheet flooring, adhesively installed.

C. Interlocking, loose-laid rubber tile.

D. Painted game lines.

E. Accessories.

2.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors.

C. Section 03 5400 - Cast Underlayment.

D. Section 09 0561 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, removal of existing floor coverings, cleaning, and preparation.

E. Section 09 6500 - Resilient Flooring.

2.03 REFERENCE STANDARDS

A. DIN EN 14904 - Surfaces for Sports Areas – Indoor Surfaces for Multi-Sports Use – Specification 2006.

2.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed data sheets for products specified.

C. Shop Drawings: Fabrication and installation details, and layout, colors, and widths of game lines and equipment locations.

D. Selection Samples: Manufacturer's color charts for flooring materials specified and game line paints, indicating full range of colors and textures available.

E. Test Reports: Submit test reports showing compliance with DIN EN 14904.

F. Sustainable Design Submittal: Submit VOC content documentation for flooring and adhesives.

2.05 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer certified in writing by the flooring manufacturer to be qualified for installation of specified flooring system.

B. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

2.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in unopened containers clearly labeled with manufacturer's name and identification of contents.

B. Store materials in dry and clean location until needed for installation. During installation, handle in a manner that will prevent marring and soiling of finished surfaces.

2.07 FIELD CONDITIONS

A. Maintain temperature in spaces to receive adhesively installed resilient flooring within range of 70 to 95 degrees F (21 to 35 degrees C) for not less than 48 hours before the beginning of installation and for not less than 48 hours after installation has been completed. Subsequently, do not allow temperature in installed spaces to drop below 50 degrees F (10 degrees C) or to go above 100 degrees F (38 degrees C).

PART 2 PRODUCTS

3.01 PREFORMED ATHLETIC FLOORING

A. Manufacturers: All products by the same manufacturer.

1. Burke Flooring; [____]: www.burkeflooring.com/#sle.
2. [_____].
3. Substitutions: See Section 01 6000 - Product Requirements.

B. Rubber Sheet Flooring: Recycled SBR (styrene butadiene rubber) and colored EPDM granules with urethane binder, lengths to avoid transverse seams.

1. Thickness: Minimum 1/4 inch (6.35 mm).
2. Sheet Width: Minimum 48 inches (1220 mm).
3. Tensile Strength: Minimum 150 psi (1.0 MPa), per ASTM D412.
4. Color: Black.

C. Vinyl Sheet Flooring:

1. Wearing Surface: Pure polyvinyl chloride, mechanically extruded and uniformly resilient material with uniform color throughout thickness.
2. Backing: None.
3. Sheet Thickness: Minimum 5/32 inch (4.0 mm).
4. Sheet Width: Minimum 48 inches (1220 mm).
5. Sheet Lengths: As necessary to minimize transverse seams.
6. Tensile Strength: Minimum 1000 psi (6.9 MPa), per ASTM D412.
7. Durometer Hardness, Type A: Minimum of 65, when tested in accordance with ASTM D2240.
8. Seaming Method: Welding with heat or chemical.
9. Surface Texture: Smooth.
10. Color: As selected from manufacturer's standards.

D. Rubber Tile Flooring: Recycled SBR (styrene butadiene rubber) and colored EPDM granules with urethane binder.

1. Thickness: Minimum 5/16 inch (8.0 mm).
2. Size: Nominal [__] inch ([___] mm) square.
3. Tensile Strength: Minimum 150 psi (1.0 MPa), per ASTM D412.
4. Surface Texture: Smooth.

5. Color: As selected from manufacturer's standards.
6. Products:
    a. Burke Flooring; Ecofitness Athletic Rubber Flooring: www.burkeflooring.com/#sle.
    b. Dinoflex Group; Next Step High Impact: www.dinoflex.com/#sle.
    c. [_____].

E. Rubber Mat: Recycled SBR (styrene butadiene rubber) and colored EPDM granules.
1. Products:
    a. U.S. Rubber Recycling, Inc; Survivor Crossfit Mats: www.usrubber.com/#sle.
    b. [_____].
    c. [_____].
    d. Substitutions: See Section 01 6000 - Product Requirements.

3.02 ACCESSORIES

A. Leveling Compound: Latex-modified cement formulation as recommended by flooring manufacturer for substrate conditions.

B. Flooring Adhesive: Waterproof; types recommended by flooring manufacturer.

PART 3 EXECUTION

4.01 EXAMINATION

A. Examine substrates for conditions detrimental to installation of athletic flooring. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of athletic flooring to substrate.

C. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for resilient flooring installation by testing for moisture and pH.
1. Conduct tests by an independent testing agency acceptable to Owner.
    a. Acceptable Testing Agencies:
        1) Independent Floor Testing and Inspection, Inc. (IFTI): www.ifti.com/#sle.
        2) Other testing agency approved by Owner.
2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

4.02 PREPARATION

A. Prepare floor substrates for installation of flooring in accordance with Section 09 0561.

4.03 INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Resilient Sheet Flooring:
1. Unroll flooring and allow to relax before beginning installation.

2. Mix adhesive thoroughly and apply to substrate with notched trowel. Roll flooring into fresh adhesive, overlapping end seams and double cutting, butting factory edges and compression fitting.
3. Roll entire flooring surface with steel roller to assure adhesion to substrate and eliminate air bubbles.
4. Immediately remove any adhesive from flooring surface, using chemical recommended by flooring manufacturer.
5. Weld seams using techniques and equipment recommended by manufacturer.
6. Lay out game lines using tape and taping machine approved by flooring manufacturer. Apply game line paint with roller, and allow to dry before removing tape.
7. Apply transparent top coat over flooring if recommended by manufacturer, to achieve a uniform finished appearance.

D. Rubber Tile Flooring:

1. Lay out center lines in spaces to receive tile flooring, based on location of principal walls. Start tile installation from center, and adjust as necessary to avoid tiles less than one-half width at perimeter.
2. Lay tiles square with room axis, matching for color and pattern by selecting from cartons and mixing as recommended by manufacturer.
3. Spread only enough adhesive to permit installation of materials before initial set.
4. Fit joints and butt seams tightly; press with heavy roller to attain full adhesion.
5. Install loose-laid tile in a staggered pattern, fit interlocking edges tightly.

4.04 CLEANING

A. Clean flooring using methods recommended by manufacturer.

4.05 PROTECTION

A. Protect finished athletic flooring from construction traffic to ensure that it is without damage upon Date of Substantial Completion.

END OF SECTION

SECTION 09 6566
RESILIENT ATHLETIC FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rubber sheet flooring, adhesively installed.

B. Vinyl sheet flooring, adhesively installed.

C. Interlocking, loose-laid rubber tile.

D. Painted game lines.

E. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors.

C. Section 03 5400 - Cast Underlayment.

D. Section 09 0561 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, removal of existing floor coverings, cleaning, and preparation.

E. Section 09 6500 - Resilient Flooring.

1.03 REFERENCE STANDARDS

A. DIN EN 14904 - Surfaces for Sports Areas – Indoor Surfaces for Multi-Sports Use – Specification 2006.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed data sheets for products specified.

C. Shop Drawings: Fabrication and installation details, and layout, colors, and widths of game lines and equipment locations.

D. Selection Samples: Manufacturer's color charts for flooring materials specified and game line paints, indicating full range of colors and textures available.

E. Verification Samples: Actual flooring material specified, not less than 12 inch (305 mm) square, mounted on solid backing.

1. Include samples of game lines, illustrating colors selected.

F. Test Reports: Submit test reports showing compliance with DIN EN 14904.

G. Sustainable Design Submittal: Submit VOC content documentation for flooring and adhesives.

H. Concrete Sub-floor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer certified in writing by the flooring manufacturer to be qualified for installation of specified flooring system.

B. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in unopened containers clearly labeled with manufacturer's name and identification of contents.

B. Store materials in dry and clean location until needed for installation. During installation, handle in a manner that will prevent marring and soiling of finished surfaces.

1.07 FIELD CONDITIONS

A. Maintain temperature in spaces to receive adhesively installed resilient flooring within range of 70 to 95 degrees F (21 to 35 degrees C) for not less than 48 hours before the beginning of installation and for not less than 48 hours after installation has been completed. Subsequently, do not allow temperature in installed spaces to drop below 50 degrees F (10 degrees C) or to go above 100 degrees F (38 degrees C).

PART 2 PRODUCTS

2.01 PREFORMED ATHLETIC FLOORING

A. Manufacturers: All products by the same manufacturer.

1. Burke Flooring: www.burkeflooring.com/#sle.
2. Substitutions: See Section 01 6000 - Product Requirements.

B. Rubber Sheet Flooring: Recycled SBR (styrene butadiene rubber) and colored EPDM granules with urethane binder, lengths to avoid transverse seams.

1. Thickness: Minimum 1/4 inch (6.35 mm).
2. Sheet Width: Minimum 48 inches (1220 mm).
3. Tensile Strength: Minimum 150 psi (1.0 MPa), per ASTM D412.
4. Color: Black.

C. Vinyl Sheet Flooring:

1. Wearing Surface: Pure polyvinyl chloride, mechanically extruded and uniformly resilient material with uniform color throughout thickness.
2. Backing: None.
3. Sheet Thickness: Minimum 5/32 inch (4.0 mm).
4. Sheet Width: Minimum 48 inches (1220 mm).
5. Sheet Lengths: As necessary to minimize transverse seams.
6. Tensile Strength: Minimum 1000 psi (6.9 MPa), per ASTM D412.
7. Durometer Hardness, Type A: Minimum of 65, when tested in accordance with ASTM D2240.
8. Seaming Method: Welding with heat or chemical.
9. Surface Texture: Smooth.
10. Color: As selected from manufacturer's standards.

D. Rubber Tile Flooring: Recycled SBR (styrene butadiene rubber) and colored EPDM granules with urethane binder.

1. Thickness: Minimum 5/16 inch (8.0 mm).
2. Tensile Strength: Minimum 150 psi (1.0 MPa), per ASTM D412.
3. Surface Texture: Smooth.
4. Color: As selected from manufacturer's standards.

5. Products:
    a. Burke Flooring; Ecofitness Athletic Rubber Flooring: www.burkeflooring.com/#sle.
    b. Dinoflex Group; Next Step High Impact: www.dinoflex.com/#sle.

E. Rubber Mat: Recycled SBR (styrene butadiene rubber) and colored EPDM granules.
1. Products:
    a. U.S. Rubber Recycling, Inc; Survivor Crossfit Mats: www.usrubber.com/#sle.
    b. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ACCESSORIES

A. Leveling Compound: Latex-modified cement formulation as recommended by flooring manufacturer for substrate conditions.

B. Flooring Adhesive: Waterproof; types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates for conditions detrimental to installation of athletic flooring. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of athletic flooring to substrate.

C. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for resilient flooring installation by testing for moisture and pH.
1. Conduct tests by an independent testing agency acceptable to Owner.
    a. Acceptable Testing Agencies:
        1) Independent Floor Testing and Inspection, Inc. (IFTI): www.ifti.com/#sle.
        2) Other testing agency approved by Owner.
2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Prepare floor substrates for installation of flooring in accordance with Section 09 0561.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Resilient Sheet Flooring:
1. Unroll flooring and allow to relax before beginning installation.
2. Mix adhesive thoroughly and apply to substrate with notched trowel. Roll flooring into fresh adhesive, overlapping end seams and double cutting, butting factory edges and compression fitting.
3. Roll entire flooring surface with steel roller to assure adhesion to substrate and eliminate air bubbles.
4. Immediately remove any adhesive from flooring surface, using chemical recommended by flooring manufacturer.

5. Weld seams using techniques and equipment recommended by manufacturer.
6. Lay out game lines using tape and taping machine approved by flooring manufacturer. Apply game line paint with roller, and allow to dry before removing tape.
7. Apply transparent top coat over flooring if recommended by manufacturer, to achieve a uniform finished appearance.

D. Rubber Tile Flooring:

1. Lay out center lines in spaces to receive tile flooring, based on location of principal walls. Start tile installation from center, and adjust as necessary to avoid tiles less than one-half width at perimeter.
2. Lay tiles square with room axis, matching for color and pattern by selecting from cartons and mixing as recommended by manufacturer.
3. Spread only enough adhesive to permit installation of materials before initial set.
4. Fit joints and butt seams tightly; press with heavy roller to attain full adhesion.
5. Install loose-laid tile in a staggered pattern, fit interlocking edges tightly.

3.04 CLEANING

A. Clean flooring using methods recommended by manufacturer.

3.05 PROTECTION

A. Protect finished athletic flooring from construction traffic to ensure that it is without damage upon Date of Substantial Completion.

END OF SECTION

SECTION 09 6623
RESINOUS MATRIX TERRAZZO FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Epoxy matrix terrazzo with ground and polished finish.

B. Divider strips.

C. Recessed mat frames within terrazzo field.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Restrictions.

B. Section 03 3000 - Cast-in-Place Concrete: Concrete subfloor with steel trowel finish.

C. Section 05 5100 - Metal Stairs: Formed steel stair pans.

D. Section 07 9200 - Joint Sealants: Sealing joints between terrazzo work and adjacent construction and fixtures.

E. Section 07 9513 - Expansion Joint Cover Assemblies: Building expansion joint covers.

F. Section 09 6700 - Fluid-Applied Flooring: Epoxy matrix flooring that is not ground.

1.03 REFERENCE STANDARDS

A. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair 2013.

B. NTMA (GRAD) - Aggregate Gradation Standards Current Edition.

C. NTMA (EPOXY) - Epoxy Terrazzo Specifications Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for divider strips, control joint strips, expansion joints and sealer; include printed copy of current NTMA recommendations for type of terrazzo specified.

C. Shop Drawings: Indicate divider strip and control and expansion joint layout, and details of adjacent components. For precast units, detail profile and anchorage requirements.

D. Samples: Submit two samples, by [8" x 8"] inch ([203 x 203] mm) in size illustrating color, chip size and variation, chip gradation, matrix color, and typical divider strip.

E. Manufacturer's Qualification Statement.

F. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with NTMA recommendations as posted at their web site at www.ntma.com.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section.

1. Associate member firm of the National Terrazzo and Mosaic Association, Inc.

C. Installer Qualifications: Company specializing in performing the type of work specified in this section.

1. Contractor member of the National Terrazzo and Mosaic Association, Inc.

1.06 MOCK-UP

A. Construct mock-up of terrazzo illustrating appearance of finished work in each configuration required. Size mock-up to be not less than 3 by 3 feet (1 by 1 m).

B. Locate where directed.

C. Mock-up may remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store terrazzo materials in a dry, secure area.

B. Maintain minimum temperature of 60 degrees F (16 degrees C).

C. Keep products away from fire or open flame.

1.08 FIELD CONDITIONS

A. Do not install terrazzo when temperature is below 50 degrees F (10 degrees C) or above 90 degrees F (32 degrees C).

B. Maintain temperature within specified range 24 hours before, during, and 72 hours after installation of flooring.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design - Resinous Matrix Terrazzo Flooring: Key Resin; Key Epoxy Terrazzo System: www.keyresin.com/#sle.

B. Other Acceptable Manufacturers - Resinous Matrix Terrazzo Flooring:

1. Sherwin-Williams Company: General Polymers Brand: www.generalpolymers.com/#sle.
2. Sika Corporation; Sikafloor Terrazzo: www.sikafloorusa.com/#sle.
3. Terrazzco; TERRAZZCO Epoxy Terrazzo System, a brand of Concord Terrazzo Company, Inc: www.terrazzco.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 EPOXY MATRIX TERRAZZO APPLICATIONS

A. Floors:

1. Thickness: 3/8 inch (9 mm), nominal.
2. Aggregate Type: Marble chips.

B. Wall Base:

1. Thickness: Same as floors.
2. Aggregate Type and Size: Same as floors.

C. Stairs - :

1. Thickness: Same as floors.
2. Aggregate Type and Size: Same as floors.

2.03 MATERIALS

A. Epoxy Matrix Terrazzo: Aggregate and matrix mix applied to substrate, troweled flat, and ground smooth.

1. Mix Proportions: As required to achieve appearance specified.
2. Mix Proportions: Three parts aggregate chip; one part aggregate dust; one part matrix.

B. Matrix: Two component resin and epoxy hardener with mineral filler and color pigment, non-volatile, thermo-setting.

1. Products:

a. Terrazzco; EZpour Epoxy #158 a brand of Concord Terrazzo Company, Inc: www.terrazzco.com/#sle.

b. Terrazzo & Marble Supply Companies; Terroxy Epoxy Matrix: www.tmsupply.com/#sle.

c. Substitutions: See Section 01 6000 - Product Requirements.

C. Aggregate: Type as indicated; sized in accordance with NTMA aggregate gradation standards; color(s) as indicated, uniform in color.

1. Products - Glass Chips:

a. American Specialty Glass: www.americanspecialtyglass.com/#sle.

b. [_____].

c. [_____].

D. Finishing Grout: Epoxy, color to match terrazzo matrix.

2.04 ACCESSORIES

A. Divider Strips: 1/8 inch (3 mm) thick zinc exposed top strip, zinc coated steel concealed bottom strip, with anchoring features.

B. Control Joint Strips: 1/8 inch (3 mm) nominal width zinc exposed top strips, zinc coated steel concealed bottom strips, 1/8 inch (3 mm) wide neoprene filler strip between vertical strips, with anchoring features.

C. Divider and Control Joint Strip Height: To suit thickness of terrazzo topping, with allowance for grinding.

D. Base Cap, Base Divider Strip, and Separator Strip: Match divider strips.

E. Non-Slip Inserts: Provide channel-shaped inserts filled with a mixture of resin and fine, abrasive aggregate.

F. Sealer: Colorless, non-yellowing, penetrating liquid type to completely seal matrix surface; not detrimental to terrazzo components.

1. Products:

a. Terrazzo & Marble Supply Companies; T-Rx: www.tmsupply.com/#sle.

b. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive terrazzo.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive terrazzo.

C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of materials to sub-floor surfaces.

D. Verify that wood sub-floors have 12 percent maximum moisture content.

E. Verify that concrete sub-floor surfaces are ready for terrazzo installation by testing for moisture vapor emission, internal relative humidity and alkalinity; obtain instructions if test results are not within limits

recommended by terrazzo materials manufacturer.

F. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Clean substrate of foreign matter.

B. Prepare concrete subfloor by mechanically abrading surface in accordance with manufacturer's instructions.

C. Prepare concrete surfaces according to ICRI 310.2R.

D. Apply primer in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. Saw cut substrate to install divider and control joint strips.

B. Install control joint strips straight and flat to locations indicated.

C. Install divider strips according to pattern approved on shop drawings.

D. Install non-slip inserts in floors and stair treads where indicated.

E. Install base and border divider and control joint strips to match floor pattern.

F. Install terminating cap strip at top of base; attach securely to wall substrate.

G. Place terrazzo mix over substrate to thickness indicated.

H. Anchor precast units as indicated on drawings.

I. Install precast units using specified setting material.

3.04 FINISHING

A. Finish terrazzo to NTMA requirements.

B. Grind terrazzo surfaces with power disc machine; sequence with coarse to fine grit abrasive, using a wet method or using a dry grinder with vacuum to control dust.

C. Apply grout to fill voids exposed from grinding.

D. Remove grout coat by grinding, using a fine grit abrasive.

3.05 TOLERANCES

A. Maximum Variation from Flat Surface: 1/4 inch in 10 feet (6 mm in one m).

3.06 CLEANING

A. Immediately after terrazzo has dried, apply sealer in accordance with manufacturer's instructions.

B. Polish surfaces in accordance with manufacturer's instructions.

3.07 PROTECTION

A. Protect finished terrazzo from damage due to subsequent construction until Date of Substantial Completion.

END OF SECTION

SECTION 09 6623
RESINOUS MATRIX TERRAZZO FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Epoxy matrix terrazzo with ground and polished finish.

B. Divider strips.

C. Recessed mat frames within terrazzo field.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Restrictions.

B. Section 03 3000 - Cast-in-Place Concrete: Concrete subfloor with steel trowel finish.

C. Section 05 5100 - Metal Stairs: Formed steel stair pans.

D. Section 07 9200 - Joint Sealants: Sealing joints between terrazzo work and adjacent construction and fixtures.

E. Section 07 9513 - Expansion Joint Cover Assemblies: Building expansion joint covers.

F. Section 09 6700 - Fluid-Applied Flooring: Epoxy matrix flooring that is not ground.

1.03 REFERENCE STANDARDS

A. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair 2013.

B. NTMA (GRAD) - Aggregate Gradation Standards Current Edition.

C. NTMA (EPOXY) - Epoxy Terrazzo Specifications Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for divider strips, control joint strips, expansion joints and sealer; include printed copy of current NTMA recommendations for type of terrazzo specified.

C. Shop Drawings: Indicate divider strip and control and expansion joint layout, and details of adjacent components. For precast units, detail profile and anchorage requirements.

D. Samples: Submit two samples, by [8" x 8"] inch ([203 x 203] mm) in size illustrating color, chip size and variation, chip gradation, matrix color, and typical divider strip.

E. Manufacturer's Qualification Statement.

F. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with NTMA recommendations as posted at their web site at www.ntma.com.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section.

1. Associate member firm of the National Terrazzo and Mosaic Association, Inc.

C. Installer Qualifications: Company specializing in performing the type of work specified in this section.

1. Contractor member of the National Terrazzo and Mosaic Association, Inc.

1.06 MOCK-UP

A. Construct mock-up of terrazzo illustrating appearance of finished work in each configuration required. Size mock-up to be not less than 3 by 3 feet (1 by 1 m).

B. Locate where directed.

C. Mock-up may remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store terrazzo materials in a dry, secure area.

B. Maintain minimum temperature of 60 degrees F (16 degrees C).

C. Keep products away from fire or open flame.

1.08 FIELD CONDITIONS

A. Do not install terrazzo when temperature is below 50 degrees F (10 degrees C) or above 90 degrees F (32 degrees C).

B. Maintain temperature within specified range 24 hours before, during, and 72 hours after installation of flooring.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design - Resinous Matrix Terrazzo Flooring: Key Resin; Key Epoxy Terrazzo System: www.keyresin.com/#sle.

B. Other Acceptable Manufacturers - Resinous Matrix Terrazzo Flooring:

1. Sherwin-Williams Company: General Polymers Brand: www.generalpolymers.com/#sle.
2. Sika Corporation; Sikafloor Terrazzo: www.sikafloorusa.com/#sle.
3. Terrazzco; TERRAZZCO Epoxy Terrazzo System, a brand of Concord Terrazzo Company, Inc: www.terrazzco.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 EPOXY MATRIX TERRAZZO APPLICATIONS

A. Floors:

1. Aggregate Type: Marble chips.

B. Wall Base:

1. Thickness: Same as floors.
2. Aggregate Type and Size: Same as floors.

C. Stairs - :

1. Thickness: Same as floors.
2. Aggregate Type and Size: Same as floors.

2.03 MATERIALS

A. Epoxy Matrix Terrazzo: Aggregate and matrix mix applied to substrate, troweled flat, and ground smooth.

1. Mix Proportions: As required to achieve appearance specified.
2. Mix Proportions: Three parts aggregate chip; one part aggregate dust; one part matrix.

B. Matrix: Two component resin and epoxy hardener with mineral filler and color pigment, non-volatile, thermo-setting.

1. Products:
    a. Terrazzco; EZpour Epoxy #158 a brand of Concord Terrazzo Company, Inc: www.terrazzco.com/#sle.
    b. Terrazzo & Marble Supply Companies; Terroxy Epoxy Matrix: www.tmsupply.com/#sle.
    c. Substitutions: See Section 01 6000 - Product Requirements.

C. Aggregate: Type as indicated; sized in accordance with NTMA aggregate gradation standards; color(s) as indicated, uniform in color.
    1. Products - Glass Chips:
        a. American Specialty Glass: www.americanspecialtyglass.com/#sle.

D. Finishing Grout: Epoxy, color to match terrazzo matrix.

2.04 ACCESSORIES

A. Divider Strips: 1/8 inch (3 mm) thick zinc exposed top strip, zinc coated steel concealed bottom strip, with anchoring features.

B. Control Joint Strips: 1/8 inch (3 mm) nominal width zinc exposed top strips, zinc coated steel concealed bottom strips, 1/8 inch (3 mm) wide neoprene filler strip between vertical strips, with anchoring features.

C. Divider and Control Joint Strip Height: To suit thickness of terrazzo topping, with allowance for grinding.

D. Base Cap, Base Divider Strip, and Separator Strip: Match divider strips.

E. Non-Slip Inserts: Provide channel-shaped inserts filled with a mixture of resin and fine, abrasive aggregate.

F. Anchors and Reinforcement for Precast Units: As recommended by manufacturer for type of installation.

G. Sealer: Colorless, non-yellowing, penetrating liquid type to completely seal matrix surface; not detrimental to terrazzo components.
    1. Products:
        a. Terrazzo & Marble Supply Companies; T-Rx: www.tmsupply.com/#sle.
        b. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive terrazzo.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive terrazzo.

C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of materials to sub-floor surfaces.

D. Verify that wood sub-floors have 12 percent maximum moisture content.

E. Verify that concrete sub-floor surfaces are ready for terrazzo installation by testing for moisture vapor emission, internal relative humidity and alkalinity; obtain instructions if test results are not within limits recommended by terrazzo materials manufacturer.

F. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Clean substrate of foreign matter.

B. Prepare concrete subfloor by mechanically abrading surface in accordance with manufacturer's instructions.

C. Prepare concrete surfaces according to ICRI 310.2R.

D. Apply primer in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. Saw cut substrate to install divider and control joint strips.

B. Install control joint strips straight and flat to locations indicated.

C. Install divider strips according to pattern approved on shop drawings.

D. Install non-slip inserts in floors and stair treads where indicated.

E. Install base and border divider and control joint strips to match floor pattern.

F. Install terminating cap strip at top of base; attach securely to wall substrate.

G. Place terrazzo mix over substrate to thickness indicated.

H. Anchor precast units as indicated on drawings.

I. Install precast units using specified setting material.

3.04 FINISHING

A. Finish terrazzo to NTMA requirements.

B. Produce terrazzo finish surface to match approved mock-up, with 70 percent chip exposed.

C. Grind terrazzo surfaces with power disc machine; sequence with coarse to fine grit abrasive, using a wet method or using a dry grinder with vacuum to control dust.

D. Apply grout to fill voids exposed from grinding.

E. Remove grout coat by grinding, using a fine grit abrasive.

F. Hand grind vertical and curved surfaces similarly.

3.05 TOLERANCES

A. Maximum Variation from Flat Surface: 1/4 inch in 10 feet (6 mm in one m).

B. Maximum Variation from Level (Except Surfaces Sloping to Drain): 1/8 inch (3 mm).

3.06 CLEANING

A. Scrub and clean terrazzo surfaces with neutral pH cleaner in accordance with manufacturer's instructions. Let dry.

B. Immediately after terrazzo has dried, apply sealer in accordance with manufacturer's instructions.

C. Polish surfaces in accordance with manufacturer's instructions.

3.07 PROTECTION

A. Protect finished terrazzo from damage due to subsequent construction until Date of Substantial Completion.

END OF SECTION

SECTION 09 6813
TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet tile, fully adhered.

B. Removal of existing carpet tile.

C. Matching roll carpet for direct glue installation on .

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 01 7419 - Construction Waste Management and Disposal: Reclamation/Recycling of .

C. Section 09 0561 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, removal of existing floor coverings, cleaning, and preparation.

D. Section 09 6816 - Sheet Carpeting: Broadloom carpet.

E. Section 22 1006 - Plumbing Piping Specialties: Plumbing floor cover plate with recess for carpet.

F. Section 26 0519.13 - Undercarpet Electrical Power Cables: Undercarpet flat wiring.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Shop Drawings: Indicate layout of joints.

D. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

E. Sustainable Design Submittal: Submit VOC content documentation for adhesives.

F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

G. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

H. Maintenance Materials: Furnish the following for Owner 's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

1.05 FIELD CONDITIONS

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Tile Carpeting:

1. Milliken & Company: www.milliken.com/#sle.
2. Tandus: www.tandus.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Tile Carpeting: Tufted, manufactured in one color dye lot.

B. Roll Carpet: Same manufacturer, type, color and pattern, and face fiber characteristics as carpet tile, manufactured in same color dye lot as tile.

2.03 ACCESSORIES

A. Sub-Floor Filler: White premix latex; type recommended by flooring material manufacturer.

B. Base Cap: type, finish, .

C. Stair Nosing: Rubber type, square nose, ribbed top surface, one piece per stair tread width.

D. Adhesives:

1. Compatible with materials being adhered; maximum VOC content as specified in Section 01 6116.

E. Carpet Tile Adhesive:

1. Products:
   a. Stauf USA, LLC; D737 High-Tack: www.staufusa.com/#sle.
   b. TEC, an H.B. Fuller Construction Products Brand; TEC 749 Releasable Pressure Sensitive Adhesive: www.tecspecialty.com/#sle.
   c. Substitutions: Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet tile.

C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.

D. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for flooring installation by testing for moisture and pH.

1. Test in accordance with Section 09 0561.
2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Remove existing carpet tile.

B. Prepare floor substrates for installation of flooring in accordance with Section 09 0561.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install carpet tile in accordance with manufacturer's instructions.

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.

F. Locate change of color or pattern between rooms under door centerline.

G. Fully adhere carpet tile to substrate.

H. Adhere carpet tile as base finish up vertical surfaces to form base. Terminate top of base with cap strip.

I. Trim carpet tile neatly at walls and around interruptions.

J. Complete installation of edge strips, concealing exposed edges.

3.04 INSTALLATION ON STAIRS

A. Use one piece of carpet for each tread and the riser below. Apply seam adhesive to all cut edges.

B. Lay carpet with pile direction in the length of the stair.

C. Adhere carpet tight to stair treads and risers.

3.05 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 6813
TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet tile, fully adhered.

B. Removal of existing carpet tile.

C. Matching roll carpet for direct glue installation on .

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 01 7419 - Construction Waste Management and Disposal: Reclamation/Recycling of .

C. Section 09 0561 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, removal of existing floor coverings, cleaning, and preparation.

D. Section 09 6816 - Sheet Carpeting: Broadloom carpet.

E. Section 22 1006 - Plumbing Piping Specialties: Plumbing floor cover plate with recess for carpet.

F. Section 26 0519.13 - Undercarpet Electrical Power Cables: Undercarpet flat wiring.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Shop Drawings: Indicate layout of joints.

D. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

E. Sustainable Design Submittal: Submit VOC content documentation for adhesives.

F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

G. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

H. Maintenance Materials: Furnish the following for Owner 's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.05 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Tile Carpeting:

1. Milliken & Company: www.milliken.com/#sle.
2. Tandus: www.tandus.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Tile Carpeting: Tufted, manufactured in one color dye lot.

B. Roll Carpet: Same manufacturer, type, color and pattern, and face fiber characteristics as carpet tile, manufactured in same color dye lot as tile.

2.03 ACCESSORIES

A. Sub-Floor Filler: White premix latex; type recommended by flooring material manufacturer.

B. Base Cap: type, finish, .

C. Stair Nosing: Rubber type, square nose, ribbed top surface, one piece per stair tread width.

D. Adhesives:

1. Compatible with materials being adhered; maximum VOC content as specified in Section 01 6116.

E. Carpet Tile Adhesive:

1. Products:
   a. Stauf USA, LLC; D737 High-Tack: www.staufusa.com/#sle.
   b. TEC, an H.B. Fuller Construction Products Brand; TEC 749 Releasable Pressure Sensitive Adhesive: www.tecspecialty.com/#sle.
   c. Substitutions: Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet tile.

C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.

D. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for flooring installation by testing for moisture and pH.

1. Test in accordance with Section 09 0561.
2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Remove existing carpet tile.

B. Prepare floor substrates for installation of flooring in accordance with Section 09 0561.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install carpet tile in accordance with manufacturer's instructions.

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.

F. Locate change of color or pattern between rooms under door centerline.

G. Fully adhere carpet tile to substrate.

H. Adhere carpet tile as base finish up vertical surfaces to form base. Terminate top of base with cap strip.

I. Trim carpet tile neatly at walls and around interruptions.

J. Complete installation of edge strips, concealing exposed edges.

3.04 INSTALLATION ON STAIRS

A. Use one piece of carpet for each tread and the riser below. Apply seam adhesive to all cut edges.

B. Lay carpet with pile direction in the length of the stair.

C. Adhere carpet tight to stair treads and risers.

3.05 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 6816
SHEET CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet, stretch-in with cushion underlay and direct glued.

B. Removal of existing carpet.

C. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 01 7419 - Construction Waste Management and Disposal: Reclamation/Recycling of new carpet scrap, new cushion scrap, removed carpet and removed carpet cushion.

C. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied carpet.

D. Section 03 5400 - Cast Underlayment.

E. Section 09 0561 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, removal of existing floor coverings, cleaning, and preparation.

F. Section 09 6813 - Tile Carpeting.

1.03 REFERENCE STANDARDS

A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials 2016.

B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source 2017.

C. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 2015.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Shop Drawings: Indicate seaming plan, method of joining seams, direction of carpet pile and pattern, location of edge moldings and edge bindings, layout of flat wire system.

D. Samples: Submit two samples 8" by 8" in size illustrating color and pattern for each carpet and cushion material specified.

E. Submit two, 4" x 8" long samples of edge strip for each color specified.

F. Sustainable Design Submittal: Submit VOC content documentation for adhesives.

G. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

H. Maintenance Materials: Furnish the following for Owner 's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional requirements.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing carpet with minimum three years documented experience.

C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.06 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

B. Maintain minimum 70 degrees F (21 degrees C) ambient temperature 24 hours prior to, during and 24 hours after installation.

C. Ventilate installation area during installation and for 72 hours after installation.

PART 2 PRODUCTS

2.01 CARPET

A. Carpet:

1. Roll Width: .
2. Color: .
3. Pattern: .
4. Critical Radiant Flux: Minimum of 0.22 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
5. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
6. VOC Content: Comply with Section 01 6116.
7. Substitutions: See Section 01 6000 - Product Requirements.

B. Carpet: Tufted, nylon.

1. Critical Radiant Flux: Minimum of 0.22 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
2. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
3. VOC Content: Comply with Section 01 6116.
4. Color:
5. Pattern:
6. Roll Width: .
7. Static Control Fiber: .
8. Maximum Electrostatic Charge: 3 Kv. at 20 percent relative humidity (RH).
9. Rows:
10. Gage:
11. Stitche:
12. Yarn Size:

C. Carpet: Woven, wilton weave, wool.

1. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").

2. VOC Content: Comply with Section 01 6116.
3. Color: .
4. Pattern: .
5. Roll Width:
6. Static Control Fiber: [_____].
7. Rows: .
8. Pitch: .
9. Wire Height: .
10. Yarn Size: .
11. Pile Weight: .
12. Density Factor:
13. Light Fastness:
14. Primary Backing:
    a. Material:
    b. Weight: .
15. Laminate:
    a. Material:
    b. Weight:
16. Secondary Backing:
    a. Material:
    b. Weight:
17. Total Weight:

2.02 CUSHION

A. Cushion: Cellular rubber.
   1. VOC Content: Comply with Section 01 6116.
   2. Nominal Thickness: .
   3. Roll Width:
   4. Weight:
   5. Density:

B. Cushion: Rubber coated hair felt.
   1. Nominal Thickness: .
   2. Roll Width:
   3. Weight:
   4. Density:

2.03 ACCESSORIES

A. Sub-Floor Filler: Type recommended by carpet manufacturer.

B. Tackless Strip: Carpet gripper, of type recommended by carpet manufacturer to suit application, with attachment devices.

C. Base Gripper: {CH#10014750} type, with special lipped edge, finish, and color..

1. Base Cap: type, finish, and color.

D. Moldings and Edge Strips: Embossed aluminum, [_____] color.

E. Adhesives:

1. Compatible with materials being adhered; maximum VOC content as specified in Section 01 6116.

F. Seam Adhesive: Recommended by carpet manufacturer.

G. Carpet Adhesive: Recommended by carpet manufacturer; releasable type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive carpet.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet.

C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesives to sub floor surfaces.

D. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for flooring installation by testing for moisture and alkalinity (pH).

1. Test in accordance with Section 09 0561.

2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Remove existing carpet and carpet cushion.

B. Prepare floor substrates for installation of flooring in accordance with Section 09 0561.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install carpet and cushion in accordance with manufacturer's instructions and CRI 104 (Commercial).

C. Verify carpet match before cutting to ensure minimal variation between dye lots.

D. Lay out carpet and locate seams in accordance with shop drawings.

1. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic.

2. Do not locate seams perpendicular through door openings.

3. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.

4. Locate change of color or pattern between rooms under door centerline.

5. Provide monolithic color, pattern, and texture match within any one area.

E. Install carpet tight and flat on subfloor, well fastened at edges, with a uniform appearance.

3.04 STRETCHED-IN CARPET

A. Install tackless strips with pins facing the wall around entire perimeter, except across door openings. Use edge strip where carpet terminates at other floor coverings.

B. Space tackless strips slightly less than carpet thickness away from vertical surfaces, but not more than 3/8 inch (9 mm).

C. Install cushion in maximum size pieces using spot adhesive to adhere to sub-floor.

D. Lay out cushion so that seams will be perpendicular to, or offset from, minimum 6 inches (150 mm) from carpet seams.

E. Butt cushion edges together and tape seams.

F. Trim cushion tight to edge of tackless strip and around projections and contours.

G. Double cut carpet seams, with accurate pattern match. Make cuts straight, true, and unfrayed. Apply seam adhesive to all cut edges immediately.

H. Join seams by hand sewing. Form seams straight, not overlapped or peaked, and free of gaps.

I. Following seaming, hook carpet onto tackless strip at one edge, power stretch, and hook firmly at other edges. Follow manufacturer's recommendations for method and amount of stretch.

J. Trim carpet neatly at walls and around interruptions. Tuck edges into space between tackless strip and wall.

3.05 DIRECT-GLUED CARPET

A. Double cut carpet seams, with accurate pattern match. Make cuts straight, true, and unfrayed. Apply seam adhesive to cut edges of woven carpet immediately.

B. Apply contact adhesive to floor uniformly at rate recommended by manufacturer. After sufficient open time, press carpet into adhesive.

C. Apply seam adhesive to the base of the edge glued down. Lay adjoining piece with seam straight, not overlapped or peaked, and free of gaps.

D. Roll with appropriate roller for complete contact of adhesive to carpet backing.

E. Trim carpet neatly at walls and around interruptions.

F. If specificed by the architect, Extend carpet as base finish up vertical surfaces to form base. Terminate top of base with cap strip.

G. Complete installation of edge strips, concealing exposed edges. Bind cut edges where not concealed by edge strips.

3.06 INSTALLATION ON STAIRS

A. Install tackless strips at back of treads, with pins facing riser, and at bottom of riser, with pins facing tread.

B. Install cushion on stair treads butt tight to applied nosing.

C. Install carpet on stairs with the run of the pile in opposite direction of anticipated traffic to avoid peaking of backing at nosings.

D. Stretch carpet over stair treads, full width in one piece. Fold carpet under 1-1/2 inches (40 mm) on each side.

3.07 CLEANING

A. Remove excess adhesive from floor and wall surfaces without damage.

B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 6816
SHEET CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet, stretch-in with cushion underlay and direct glued.

B. Removal of existing carpet.

C. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 01 7419 - Construction Waste Management and Disposal: Reclamation/Recycling of new carpet scrap, new cushion scrap, removed carpet and removed carpet cushion.

C. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied carpet.

D. Section 03 5400 - Cast Underlayment.

E. Section 09 0561 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, removal of existing floor coverings, cleaning, and preparation.

F. Section 09 6813 - Tile Carpeting.

1.03 REFERENCE STANDARDS

A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials 2016.

B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source 2017.

C. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 2015.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Shop Drawings: Indicate seaming plan, method of joining seams, direction of carpet pile and pattern, location of edge moldings and edge bindings, layout of flat wire system.

D. Samples: Submit two samples 8" by 8" in size illustrating color and pattern for each carpet and cushion material specified.

E. Submit two, 4" x 8" long samples of edge strip for each color specified.

F. Sustainable Design Submittal: Submit VOC content documentation for adhesives.

G. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

H. Maintenance Materials: Furnish the following for Owner 's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional requirements.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing carpet with minimum three years documented experience.

C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.06 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

B. Maintain minimum 70 degrees F (21 degrees C) ambient temperature 24 hours prior to, during and 24 hours after installation.

C. Ventilate installation area during installation and for 72 hours after installation.

PART 2 PRODUCTS

2.01 CARPET

A. Carpet:

1. Roll Width: .
2. Color: .
3. Pattern: .
4. Critical Radiant Flux: Minimum of 0.22 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
5. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
6. VOC Content: Comply with Section 01 6116.
7. Substitutions: See Section 01 6000 - Product Requirements.

B. Carpet: Tufted, nylon.

1. Critical Radiant Flux: Minimum of 0.22 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
2. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
3. VOC Content: Comply with Section 01 6116.
4. Color:
5. Pattern:
6. Roll Width: .
7. Static Control Fiber: .
8. Maximum Electrostatic Charge: 3 Kv. at 20 percent relative humidity (RH).
9. Rows:
10. Gage:
11. Stitche:
12. Yarn Size:

C. Carpet: Woven, wilton weave, wool.

1. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").

2. VOC Content: Comply with Section 01 6116.
3. Color: .
4. Pattern: .
5. Roll Width:
6. Static Control Fiber: .
7. Rows: .
8. Pitch: .
9. Wire Height: .
10. Yarn Size: .
11. Pile Weight: .
12. Density Factor:
13. Light Fastness:
14. Primary Backing:
    a. Material:
    b. Weight: .
15. Laminate:
    a. Material:
    b. Weight:
16. Secondary Backing:
    a. Material:
    b. Weight:
17. Total Weight:

2.02 CUSHION

A. Cushion: Cellular rubber.
   1. VOC Content: Comply with Section 01 6116.
   2. Nominal Thickness: .
   3. Roll Width:
   4. Weight:
   5. Density:

B. Cushion: Rubber coated hair felt.
   1. Nominal Thickness: .
   2. Roll Width:
   3. Weight:
   4. Density:

2.03 ACCESSORIES

A. Sub-Floor Filler: Type recommended by carpet manufacturer.

B. Tackless Strip: Carpet gripper, of type recommended by carpet manufacturer to suit application, with attachment devices.

C. Base Gripper: {CH#10014750} type, with special lipped edge, finish, and color..

1. Base Cap: type, finish, and color.

D. Moldings and Edge Strips: Embossed aluminum, [_____] color.

E. Adhesives:

1. Compatible with materials being adhered; maximum VOC content as specified in Section 01 6116.

F. Seam Adhesive: Recommended by carpet manufacturer.

G. Carpet Adhesive: Recommended by carpet manufacturer; releasable type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive carpet.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet.

C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesives to sub floor surfaces.

D. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for flooring installation by testing for moisture and alkalinity (pH).

1. Test in accordance with Section 09 0561.

2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Remove existing carpet and carpet cushion.

B. Prepare floor substrates for installation of flooring in accordance with Section 09 0561.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install carpet and cushion in accordance with manufacturer's instructions and CRI 104 (Commercial).

C. Verify carpet match before cutting to ensure minimal variation between dye lots.

D. Lay out carpet and locate seams in accordance with shop drawings.

1. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic.

2. Do not locate seams perpendicular through door openings.

3. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.

4. Locate change of color or pattern between rooms under door centerline.

5. Provide monolithic color, pattern, and texture match within any one area.

E. Install carpet tight and flat on subfloor, well fastened at edges, with a uniform appearance.

3.04 STRETCHED-IN CARPET

A. Install tackless strips with pins facing the wall around entire perimeter, except across door openings. Use edge strip where carpet terminates at other floor coverings.

B. Space tackless strips slightly less than carpet thickness away from vertical surfaces, but not more than 3/8 inch (9 mm).

C. Install cushion in maximum size pieces using spot adhesive to adhere to sub-floor.

D. Lay out cushion so that seams will be perpendicular to, or offset from, minimum 6 inches (150 mm) from carpet seams.

E. Butt cushion edges together and tape seams.

F. Trim cushion tight to edge of tackless strip and around projections and contours.

G. Double cut carpet seams, with accurate pattern match. Make cuts straight, true, and unfrayed. Apply seam adhesive to all cut edges immediately.

H. Join seams by hand sewing. Form seams straight, not overlapped or peaked, and free of gaps.

I. Following seaming, hook carpet onto tackless strip at one edge, power stretch, and hook firmly at other edges. Follow manufacturer's recommendations for method and amount of stretch.

J. Trim carpet neatly at walls and around interruptions. Tuck edges into space between tackless strip and wall.

K. Complete installation of edge strips, concealing exposed edges. Bind cut edges where not concealed by edge strips.

3.05 DIRECT-GLUED CARPET

A. Double cut carpet seams, with accurate pattern match. Make cuts straight, true, and unfrayed. Apply seam adhesive to cut edges of woven carpet immediately.

B. Apply contact adhesive to floor uniformly at rate recommended by manufacturer. After sufficient open time, press carpet into adhesive.

C. Apply seam adhesive to the base of the edge glued down. Lay adjoining piece with seam straight, not overlapped or peaked, and free of gaps.

D. Roll with appropriate roller for complete contact of adhesive to carpet backing.

E. Trim carpet neatly at walls and around interruptions.

F. If specificed by the architect, Extend carpet as base finish up vertical surfaces to form base. Terminate top of base with cap strip.

G. Complete installation of edge strips, concealing exposed edges. Bind cut edges where not concealed by edge strips.

3.06 INSTALLATION ON STAIRS

A. Install tackless strips at back of treads, with pins facing riser, and at bottom of riser, with pins facing tread.

B. Install cushion on stair treads butt tight to applied nosing.

C. Install carpet on stairs with the run of the pile in opposite direction of anticipated traffic to avoid peaking of backing at nosings.

D. Stretch carpet over stair treads, full width in one piece. Fold carpet under 1-1/2 inches (40 mm) on each side.

3.07 CLEANING

A. Remove excess adhesive from floor and wall surfaces without damage.

B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 7200
WALL COVERINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation and prime painting.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

1.03 REFERENCE STANDARDS

A. ASTM D1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes 2002 (Reapproved 2013).

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2018b.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on wall covering and adhesive.

C. Shop Drawings: Indicate wall elevations with seaming layout.

D. Samples: Submit two samples of wall covering, illustrating color, finish, and texture.

E. Test Reports: Indicate verification of flame and smoke ratings, when tested by UL.

F. Manufacturer's Installation Instructions: Indicate special procedures.

G. Maintenance Data: Submit data on cleaning, touch-up, and repair of covered surfaces.

H. Manufacturer's Qualification Statement.

I. Installer's Qualification Statement.

J. Maintenance Materials: Furnish the following for Owner 's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Wall Covering Materials: 25 linear feet (8 linear m) of each color and pattern of wall covering; store where directed.
3. Package and label each roll by manufacturer, color and pattern, and destination room number.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 MOCK-UP

A. Provide panel, full height, illustrating installed wall covering and joint seaming technique.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Inspect roll materials at arrival on site, to verify acceptability.

B. Protect packaged adhesive from temperature cycling and cold temperatures.

C. Do not store roll goods on end.

1.08 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the adhesive or wall covering product manufacturer.

B. Maintain these conditions 24 hours before, during, and after installation of adhesive and wall covering.

PART 2 PRODUCTS

2.01 WALL COVERINGS

A. General Requirements:

1. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.

2. Chemical and Stain Resistance: No visible staining or discoloration and no damage to surface texture when tested in accordance with ASTM D1308.

B. Wall Covering: Fabric-backed vinyl roll stock.

C. Wall Covering: Rigid vinyl panel.

1. Manufacturers:

a. Acoustic Ceiling Products; Fasade Wall Panels: www.acpideas.com/#sle.

b. ATI Decorative Laminates: www.atilaminates.com/#sle.

c. Substitutions: See Section 01 6000 - Product Requirements.

D. Wall Covering: , complying with the following:

1. Total Thickness: .

2. Total Weight: .

3. Roll Width: .

E. Adhesive: Type recommended by wall covering manufacturer to suit application to substrate.

F. Termination Trim: Extruded plastic, clear.

G. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.

H. Substrate Primer and Sealer: Alkyd enamel type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are prime painted and ready to receive work, and comply with requirements of wall covering manufacturer.

B. Measure moisture content of surfaces using an electronic moisture meter. Do not apply wall coverings if moisture content of substrate exceeds level recommended by wall covering manufacturer.

C. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet (3 mm in 3 m) nor vary at a rate greater than 1/16 inch/ft (1.5 mm/300 mm).

3.02 PREPARATION

A. Fill cracks in substrate and smooth irregularities with filler; sand smooth.

B. Wash impervious surfaces with tetra-sodium phosphate, rinse and neutralize; wipe dry.

C. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

D. Surfaces: Correct defects and clean surfaces that affect work of this section. Remove existing coatings that exhibit loose surface defects.

E. Marks: Seal with shellac those that may bleed through surface finishes.

F. Apply one coat of primer sealer to substrate surfaces. Allow to dry. Lightly sand smooth.

G. Vacuum clean surfaces free of loose particles.

3.03 INSTALLATION

A. Apply adhesive and wall covering in accordance with manufacturer's instructions.

B. Apply adhesive to wall surface immediately prior to application of wall covering.

C. Apply wall covering smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface.

D. Butt edges tightly.

E. Overlap adjacent panels as recommended by manufacturer.

F. Horizontal seams are not acceptable.

G. Do not seam within 2 inches (50 mm) of internal corners or within 6 inches (150 mm) of external corners.

H. Install wall covering before installation of bases and items attached to or spaced slightly from wall surface.

I. Do not install wall covering more than 1/4 inch (6 mm) below top of resilient base.

J. Cover spaces above and below windows, above doors, in pattern sequence from roll.

K. Apply wall covering to electrical wall plates prior to replacing.

L. Wall covering is required behind fin tube cabinets.

M. Install termination trim.

N. Remove excess adhesive while wet from seam before proceeding to next wall covering sheet. Wipe clean with dry cloth.

3.04 CLEANING

A. Clean wall coverings of excess adhesive, dust, dirt, and other contaminants.

B. Reinstall wall plates and accessories removed prior to work of this section.

3.05 PROTECTION

A. Do not permit construction activities at or near finished wall covering areas.

END OF SECTION

SECTION 09 7200
WALL COVERINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation and prime painting.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

1.03 REFERENCE STANDARDS

A. ASTM D1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes 2002 (Reapproved 2013).

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2018b.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on wall covering and adhesive.

C. Shop Drawings: Indicate wall elevations with seaming layout.

D. Test Reports: Indicate verification of flame and smoke ratings, when tested by UL.

E. Manufacturer's Installation Instructions: Indicate special procedures.

F. Maintenance Data: Submit data on cleaning, touch-up, and repair of covered surfaces.

G. Installer's Qualification Statement.

H. Maintenance Materials: Furnish the following for Owner 's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Wall Covering Materials: 25 linear feet (8 linear m) of each color and pattern of wall covering; store where directed.
3. Package and label each roll by manufacturer, color and pattern, and destination room number.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 MOCK-UP

A. Locate where directed.

B. Mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Inspect roll materials at arrival on site, to verify acceptability.

B. Protect packaged adhesive from temperature cycling and cold temperatures.

C. Do not store roll goods on end.

1.08 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the adhesive or wall covering product manufacturer.

B. Maintain these conditions 24 hours before, during, and after installation of adhesive and wall covering.

PART 2 PRODUCTS

2.01 WALL COVERINGS

A. General Requirements:

1. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.

2. Chemical and Stain Resistance: No visible staining or discoloration and no damage to surface texture when tested in accordance with ASTM D1308.

B. Wall Covering: Fabric-backed vinyl roll stock.

C. Wall Covering: Rigid vinyl panel.

1. Manufacturers:

a. Acoustic Ceiling Products; Fasade Wall Panels: www.acpideas.com/#sle.

b. ATI Decorative Laminates: www.atilaminates.com/#sle.

c. Substitutions: See Section 01 6000 - Product Requirements.

D. Wall Covering: , complying with the following:

1. Total Thickness: .

2. Total Weight: .

3. Roll Width: .

E. Adhesive: Type recommended by wall covering manufacturer to suit application to substrate.

F. Termination Trim: Extruded plastic, clear.

G. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.

H. Substrate Primer and Sealer: Alkyd enamel type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are prime painted and ready to receive work, and comply with requirements of wall covering manufacturer.

B. Measure moisture content of surfaces using an electronic moisture meter. Do not apply wall coverings if moisture content of substrate exceeds level recommended by wall covering manufacturer.

C. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet (3 mm in 3 m) nor vary at a rate greater than 1/16 inch/ft (1.5 mm/300 mm).

3.02 PREPARATION

A. Fill cracks in substrate and smooth irregularities with filler; sand smooth.

B. Wash impervious surfaces with tetra-sodium phosphate, rinse and neutralize; wipe dry.

C. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

D. Surfaces: Correct defects and clean surfaces that affect work of this section. Remove existing coatings that exhibit loose surface defects.

E. Marks: Seal with shellac those that may bleed through surface finishes.

F. Apply one coat of primer sealer to substrate surfaces. Allow to dry. Lightly sand smooth.

G. Vacuum clean surfaces free of loose particles.

3.03 INSTALLATION

A. Apply adhesive and wall covering in accordance with manufacturer's instructions.

B. Apply adhesive to wall surface immediately prior to application of wall covering.

C. Apply wall covering smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface.

D. Butt edges tightly.

E. Overlap adjacent panels as recommended by manufacturer.

F. Horizontal seams are not acceptable.

G. Do not seam within 2 inches (50 mm) of internal corners or within 6 inches (150 mm) of external corners.

H. Install wall covering before installation of bases and items attached to or spaced slightly from wall surface.

I. Do not install wall covering more than 1/4 inch (6 mm) below top of resilient base.

J. Cover spaces above and below windows, above doors, in pattern sequence from roll.

K. Apply wall covering to electrical wall plates prior to replacing.

L. Wall covering is required behind fin tube cabinets.

M. Install termination trim.

N. Remove excess adhesive while wet from seam before proceeding to next wall covering sheet. Wipe clean with dry cloth.

3.04 CLEANING

A. Clean wall coverings of excess adhesive, dust, dirt, and other contaminants.

B. Reinstall wall plates and accessories removed prior to work of this section.

3.05 PROTECTION

A. Do not permit construction activities at or near finished wall covering areas.

END OF SECTION

SECTION 09 8414
ACOUSTIC STRETCHED-FABRIC WALL AND CEILING SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Acoustic stretched-fabric wall system.

B. Acoustic stretched-fabric ceiling system.

C. Accessories as required for complete installation.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 09 7200 - Wall Coverings: Fabric wall coverings for adhesive application to solid wall surfaces.

C. Section 09 8430 - Sound-Absorbing Wall and Ceiling Units: Prefabricated, fabric-covered wall panels and ceiling baffles.

D. Section 10 1101 - Visual Display Boards: Prefabricated, framed tackboards and markerboards.

E. Section 10 1124 - Tackable Wall Systems: Site-fabricated, fabric-covered display walls.

1.03 REFERENCE STANDARDS

A. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use 2009.

B. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method 2017.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.
4. Specimen warranty.

C. Shop Drawings: Details indicating typical transitions to other finish surfaces.

D. Selection Samples: Fabric swatches representing manufacturer's full range of available colors, textures, and patterns.

E. Verification Samples:

1. For each fabric specified, minimum size 12 inch (305 mm) square, representing actual product in color, texture, and pattern.
2. Actual samples of each frame profile to be used, including transitions between dissimilar profiles.
3. Acoustic material, minimum size 12 inch (305 mm) square.
4. Accessory package.

F. Test Reports: Certified test data from an independent test agency verifying that wall and ceiling systems meet specified requirements for acoustical and fire performance.

G. Manufacturer's Qualification Statement.

H. Installer's Qualification Statement.

I. Maintenance Contract.

J. Warranty Documentation: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

K. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

2. Supply an additional 10 (ten) percent of accessories installed for Owner's use in maintenance of project.

3. Supply an additional 5 (five) percent of fabric installed for Owner's use in maintenance of project.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect fabric, acoustical backing, and track from excessive moisture in shipment, storage, and handling.

B. Do not deliver materials to project until wet work such as concrete and plaster has been completed.

C. Store products in manufacturer's unopened packaging until ready for installation.

D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 MOCK-UP

A. See Section 01 4000 - Quality Requirements for additional mock-up requirements.

B. Construct mock-up of acoustic stretched-fabric wall system at location indicated by Architect.

1. Minimum mock-up dimensions; 96 by 96 inches (2440 by 2440 mm).

2. Approved mock-up may remain as part of the Work.

1.08 FIELD CONDITIONS

A. Do not begin installation until interior conditions have reached temperature and humidity that will be maintained during occupancy.

B. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty for material and workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustic Stretched-Fabric Wall Systems:

1. Fabric Wall: www.fabric-wall.com/#sle.

2. Fabricmate Systems: www.fabricmate.com/#sle.

3. Substitutions: See Section 01 6000 - Product Requirements.

B. Acoustic Stretched-Fabric Ceiling Systems:

1. FabriTRAK Systems, Inc: www.fabritrak.com/#sle.
2. Novawall Systems, Inc: www.novawall.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ACOUSTIC STRETCHED-FABRIC SYSTEM

A. Acoustic Stretched-Fabric System: Field installed, fabric is stretched and set into framework and laid over acoustic material anchored to substrate. Framework consists of continuous perimeter and intermediate mounting frames anchored to substrate, and designed to permit removal and replacement of fabric within framed areas without affecting adjacent areas.

1. Surface Burning Characteristics: Flame Spread Index of 25, maximum; Smoke Developed Index of 450, maximum; when whole system is tested in accordance with ASTM E84 using mounting specified in ASTM E2573 for stretched systems.
2. Noise Reduction Coefficient (NRC): 0.80, minimum, when tested in accordance with ASTM C423, Type A mounting per ASTM E795.
3. Prefabricated, fabric covered and individually framed panels are not permitted.
4. Install fabric over acoustic material and into framework without use of adhesives, tapes, or fasteners.
5. Seams in fabric are not permitted; base the frame layout dimensions on fabric at least 72 inch (1.83 m) wide.

B. Provide materials and systems made of recycled content, at least 90 percent post-consumer or pre-consumer (post-industrial).

C. Verify that adhesives and sealants used in installation of acoustic stretched-fabric system have acceptable low VOC emission ratings.

2.03 MATERIALS

A. Frame: Extruded polymer framing system with serrated jaws of sufficient strength to hold fabric in place after repeated applications.

1. Wall Frame Size: 1/2 inch (12.7 mm) height from wall substrate with minimum 1 inch (25.4 mm) wide base.
   a. Wall Frame Shape: Square at perimeter, and square at intermediate abutting joints.
   b. Application: Apply acoustic material to wall locations as indicated on drawings.
2. Ceiling Frame Size: 1-3/8 inch (31.75 mm) height from ceiling substrate with minimum 1 inch (25.4 mm) wide base.
   a. Ceiling Frame Shape: Square at perimeter, and square at intermediate abutting joints.
   b. Application: Apply acoustic material to ceiling locations as indicated on drawings.

B. Acoustic Material:

1. Provide type of acoustic material in thickness required to achieve Noise Reduction Coefficient (NRC) indicated.
2. Ensure that thickness of acoustic material fills depth of frame as necessary for application without use of support blocking.
3. Multi-Density Fiberglass Board: Consisting of 1/8 inch (3.2 mm) thick facing sheet laminated over compressed fiberglass board, Class A fire rated in accordance with ASTM E84.

a. Overall Thickness: 1 inch (25.4 mm).

C. Rigid Blocking: Fire-retardant treated medium density fiberboard complying with ANSI A208.2, in thickness to meet project requirements.

D. Fabric: Heavy-duty fire-retardant commercial fabric, as provided by manufacturer of acoustic stretched-fabric system; color, pattern, and texture as selected from system manufacturer's fabric supplier's standard line of fabric.

E. Fasteners: As recommended by manufacturer of acoustic stretched-fabric system in accordance with project requirements.

F. Adhesives: Low VOC or water-based, approved by acoustic stretched-fabric system manufacturer, and complying with requirements of Section 01 6116.

PART 3 EXECUTION

3.01 EXAMINATION

A. Begin installation only after substrates have been properly prepared.

B. Verify that casework, markerboards, door and window jambs, finished ceiling, and other finished items adjacent or abutting the acoustic stretched-fabric system have been properly installed.

C. When preparation of substrate is the responsibility of another installer, notify Architect of unsatisfactory preparation prior to proceeding with this work.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation of this work.

B. Prepare substrate surfaces using methods as recommended by the manufacturer for achieving acceptable result as required for this work.

C. Remove wall plates and other obstacles, and properly prepare substrates to receive frames and acoustic material in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. Install acoustic stretched-fabric system at locations indicated in accordance with approved shop drawings and manufacturer's instructions.

B. Frames: Install perimeter and intermediate frames using appropriate fasteners for prepared substrate, firmly secured to ensure frames do not separate from substrate.

1. For tile or masonry substrates, apply continuous bead of adhesive along base of framing in addition to spacing of conical anchors and/or fasteners at 6 to 8 inches (152 to 203 mm) on center.
2. Follow contours of wall and scribe to adjoining work at borders, penetrations, and imperfections.
3. Install framing around openings and penetrations.
4. At outside corners, miter framing to allow installation of acoustic material and secure placement of fabric around corner without intermediate framework.
5. Allow for spacing of framework to accommodate insertion of installation tool.

C. Acoustic Material: Cut and trim acoustic material to fit snugly within perimeter and intermediate framework.

1. Apply adhesive and press acoustic material into place, maintaining constant plane.
2. Staple acoustic material as necessary to prevent air gaps and to maintain secure contact for full adhesion to substrate.

3. At fixtures mounted within areas of acoustic stretched-fabric system, install rigid blocking for backing and maintain plane of fixture surface flush with face of acoustic stretched-fabric system.

D. Fabric: Stretch fabric over acoustic material, locking edges of fabric into frame's serrated jaws using manufacturer's recommended tool. Maintain fabric weave plumb, level and true, in proper relation to building lines, without ripples, waviness, hourglass, or other deleterious effects.

1. Upon fabric installation, do not employ adhesives or mechanical fasteners of any type, and ensure fabric is free-floating and in contact with acoustic material as necessary.
2. Stapling or gluing of fabric to cores or channel framework is not permitted.
3. Provide tension in fabric sufficient to prevent sagging under anticipated changes in temperature and humidity.
4. At ceiling applications, surface of fabric shall not deviate from established ceiling plane more than 1 inch in 20 feet (1:240).

3.04 CLEANING

A. Clean exposed surfaces of acoustic stretched-fabric system in compliance with manufacturers instructions for cleaning and repair of minor damage to exposed surfaces.

B. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage to system.

3.05 PROTECTION

A. Protect installed materials upon completion of this work, using methods that will ensure that the finished work is without damage or deterioration upon Date of Substantial Completion.

3.06 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide a separate maintenance contract for specified maintenance service.

END OF SECTION

SECTION 09 8414
ACOUSTIC STRETCHED-FABRIC WALL AND CEILING SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Acoustic stretched-fabric wall system.

B. Acoustic stretched-fabric ceiling system.

C. Accessories as required for complete installation.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 09 7200 - Wall Coverings: Fabric wall coverings for adhesive application to solid wall surfaces.

C. Section 09 8430 - Sound-Absorbing Wall and Ceiling Units: Prefabricated, fabric-covered wall panels and ceiling baffles.

D. Section 10 1101 - Visual Display Boards: Prefabricated, framed tackboards and markerboards.

E. Section 10 1124 - Tackable Wall Systems: Site-fabricated, fabric-covered display walls.

1.03 REFERENCE STANDARDS

A. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use 2009.

B. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method 2017.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.
4. Specimen warranty.

C. Shop Drawings: Details indicating typical transitions to other finish surfaces.

D. Selection Samples: Fabric swatches representing manufacturer's full range of available colors, textures, and patterns.

E. Verification Samples:

1. For each fabric specified, minimum size 12 inch (305 mm) square, representing actual product in color, texture, and pattern.
2. Actual samples of each frame profile to be used, including transitions between dissimilar profiles.
3. Accessory package.

F. Test Reports: Certified test data from an independent test agency verifying that wall and ceiling systems meet specified requirements for acoustical and fire performance.

G. Manufacturer's Qualification Statement.

H. Installer's Qualification Statement.

I. Maintenance Contract.

J. Warranty Documentation: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

K. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Supply an additional 10 (ten) percent of accessories installed for Owner's use in maintenance of project.
3. Supply an additional 5 (five) percent of fabric installed for Owner's use in maintenance of project.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect fabric, acoustical backing, and track from excessive moisture in shipment, storage, and handling.

B. Do not deliver materials to project until wet work such as concrete and plaster has been completed.

C. Store products in manufacturer's unopened packaging until ready for installation.

D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 MOCK-UP

A. See Section 01 4000 - Quality Requirements for additional mock-up requirements.

B. Construct mock-up of acoustic stretched-fabric wall system at location indicated by Architect.

1. Minimum mock-up dimensions; 96 by 96 inches (2440 by 2440 mm).
2. Approved mock-up may remain as part of the Work.

1.08 FIELD CONDITIONS

A. Do not begin installation until interior conditions have reached temperature and humidity that will be maintained during occupancy.

B. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty for material and workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustic Stretched-Fabric Wall Systems:

1. Fabric Wall: www.fabric-wall.com/#sle.
2. Fabricmate Systems: www.fabricmate.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

B. Acoustic Stretched-Fabric Ceiling Systems:

1. FabriTRAK Systems, Inc: www.fabritrak.com/#sle.
2. Novawall Systems, Inc: www.novawall.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ACOUSTIC STRETCHED-FABRIC SYSTEM

A. Acoustic Stretched-Fabric System: Field installed, fabric is stretched and set into framework and laid over acoustic material anchored to substrate. Framework consists of continuous perimeter and intermediate mounting frames anchored to substrate, and designed to permit removal and replacement of fabric within framed areas without affecting adjacent areas.

1. Surface Burning Characteristics: Flame Spread Index of 25, maximum; Smoke Developed Index of 450, maximum; when whole system is tested in accordance with ASTM E84 using mounting specified in ASTM E2573 for stretched systems.
2. Noise Reduction Coefficient (NRC): 0.80, minimum, when tested in accordance with ASTM C423, Type A mounting per ASTM E795.
3. Prefabricated, fabric covered and individually framed panels are not permitted.
4. Install fabric over acoustic material and into framework without use of adhesives, tapes, or fasteners.
5. Seams in fabric are not permitted; base the frame layout dimensions on fabric at least 72 inch (1.83 m) wide.

B. Provide materials and systems made of recycled content, at least 90 percent post-consumer or pre-consumer (post-industrial).

C. Verify that adhesives and sealants used in installation of acoustic stretched-fabric system have acceptable low VOC emission ratings.

2.03 MATERIALS

A. Frame: Extruded polymer framing system with serrated jaws of sufficient strength to hold fabric in place after repeated applications.

1. Wall Frame Size: 1/2 inch (12.7 mm) height from wall substrate with minimum 1 inch (25.4 mm) wide base.
   a. Wall Frame Shape: Square at perimeter, and square at intermediate abutting joints.
   b. Application: Apply acoustic material to wall locations as indicated on drawings.
2. Ceiling Frame Size: 1-3/8 inch (31.75 mm) height from ceiling substrate with minimum 1 inch (25.4 mm) wide base.
   a. Ceiling Frame Shape: Square at perimeter, and square at intermediate abutting joints.
   b. Application: Apply acoustic material to ceiling locations as indicated on drawings.

B. Acoustic Material:

1. Provide type of acoustic material in thickness required to achieve Noise Reduction Coefficient (NRC) indicated.
2. Ensure that thickness of acoustic material fills depth of frame as necessary for application without use of support blocking.
3. Multi-Density Fiberglass Board: Consisting of 1/8 inch (3.2 mm) thick facing sheet laminated over compressed fiberglass board, Class A fire rated in accordance with ASTM E84.
   a. Overall Thickness: 1 inch (25.4 mm).

C. Rigid Blocking: Fire-retardant treated medium density fiberboard complying with ANSI A208.2, in thickness to meet project requirements.

D. Fabric: Heavy-duty fire-retardant commercial fabric, as provided by manufacturer of acoustic stretched-fabric system; color, pattern, and texture as selected from system manufacturer's fabric supplier's standard line of fabric.

E. Fasteners: As recommended by manufacturer of acoustic stretched-fabric system in accordance with project requirements.

F. Adhesives: Low VOC or water-based, approved by acoustic stretched-fabric system manufacturer, and complying with requirements of Section 01 6116.

PART 3 EXECUTION

3.01 EXAMINATION

A. Begin installation only after substrates have been properly prepared.

B. Verify that casework, markerboards, door and window jambs, finished ceiling, and other finished items adjacent or abutting the acoustic stretched-fabric system have been properly installed.

C. When preparation of substrate is the responsibility of another installer, notify Architect of unsatisfactory preparation prior to proceeding with this work.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation of this work.

B. Prepare substrate surfaces using methods as recommended by the manufacturer for achieving acceptable result as required for this work.

C. Remove wall plates and other obstacles, and properly prepare substrates to receive frames and acoustic material in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. Install acoustic stretched-fabric system at locations indicated in accordance with approved shop drawings and manufacturer's instructions.

B. Frames: Install perimeter and intermediate frames using appropriate fasteners for prepared substrate, firmly secured to ensure frames do not separate from substrate.

1. For tile or masonry substrates, apply continuous bead of adhesive along base of framing in addition to spacing of conical anchors and/or fasteners at 6 to 8 inches (152 to 203 mm) on center.
2. Follow contours of wall and scribe to adjoining work at borders, penetrations, and imperfections.
3. Install framing around openings and penetrations.
4. At outside corners, miter framing to allow installation of acoustic material and secure placement of fabric around corner without intermediate framework.
5. Allow for spacing of framework to accommodate insertion of installation tool.

C. Acoustic Material: Cut and trim acoustic material to fit snugly within perimeter and intermediate framework.

1. Apply adhesive and press acoustic material into place, maintaining constant plane.
2. Staple acoustic material as necessary to prevent air gaps and to maintain secure contact for full adhesion to substrate.
3. At fixtures mounted within areas of acoustic stretched-fabric system, install rigid blocking for backing and maintain plane of fixture surface flush with face of acoustic stretched-fabric system.

D. Fabric: Stretch fabric over acoustic material, locking edges of fabric into frame's serrated jaws using manufacturer's recommended tool. Maintain fabric weave plumb, level and true, in proper relation to building lines, without ripples, waviness, hourglass, or other deleterious effects.

1. Upon fabric installation, do not employ adhesives or mechanical fasteners of any type, and ensure fabric is free-floating and in contact with acoustic material as necessary.
2. Stapling or gluing of fabric to cores or channel framework is not permitted.
3. Provide tension in fabric sufficient to prevent sagging under anticipated changes in temperature and humidity.
4. At ceiling applications, surface of fabric shall not deviate from established ceiling plane more than 1 inch in 20 feet (1:240).

3.04 CLEANING

A. Clean exposed surfaces of acoustic stretched-fabric system in compliance with manufacturers instructions for cleaning and repair of minor damage to exposed surfaces.

B. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage to system.

3.05 PROTECTION

A. Protect installed materials upon completion of this work, using methods that will ensure that the finished work is without damage or deterioration upon Date of Substantial Completion.

3.06 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide a separate maintenance contract for specified maintenance service.

END OF SECTION

SECTION 09 8430
SOUND-ABSORBING WALL AND CEILING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sound-absorbing panels.

B. Sound-absorbing ceiling baffles.

C. Mounting accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 4100 - Architectural Wood Casework.

B. Section 09 5100 - Acoustical Ceilings: Ceiling suspension system.

C. Section 09 5153 - Direct-Applied Acoustical Ceilings.

1.03 REFERENCE STANDARDS

A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method 2017.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2018b.

C. ASTM E795 - Standard Practices for Mounting Test Specimens During Sound Absorption Tests 2016.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed data sheets for products specified.

C. Shop Drawings: Fabrication and installation details, panel layout, and fabric orientation.

D. Selection Samples: Manufacturer's color charts for fabric covering, indicating full range of fabrics, colors, and patterns available.

E. Verification Samples: Fabricated samples of each type of panel specified; 12 by 12 inch (305 by 305 mm), showing construction, edge details, and fabric covering.

F. Test Reports: Certified test data from an independent test agency verifying that panels meet specified requirements for acoustical and fire performance.

G. Manufacturer's Qualification Statement.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

2. Extra Panels: Quantity equal to 5 percent of total installed, but not less than one of each type.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company with not less than five years of experience in manufacturing acoustical products similar to those specified.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect acoustical units from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until units are needed for installation.

B. Store units flat, in dry, well-ventilated space; do not stand on end.

C. Protect edges from damage.

1.07 MOCK-UP

A. See Section 01 4000 - Quality Requirements, for additional mock-up requirements.

B. Construct mock-up of acoustical units at location as indicated by Architect.

1. Minimum mock-up dimensions; 96 by 96 inches (2440 by 2440 mm).
2. Approved mock-up may remain as part of the Work.

PART 2 PRODUCTS

2.01 FABRIC-COVERED SOUND-ABSORBING UNITS

A. Manufacturers:

1. Essi Acoustical Products Company: www.essiacoustical.com/#sle.
2. Owens Corning Conwed Designscape: www.conweddesignscape.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

B. Sound Absorbing Units: Prefinished, factory assembled fabric-covered panels.

1. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.

C. Fabric-Covered Acoustical Panels for Walls and Ceilings:

1. Panel Core: Manufacturer's standard rigid or semi-rigid fiberglass core.
2. Noise Reduction Coefficient (NRC): when tested in accordance with ASTM C423 for mounting, per ASTM E795.
3. Panel Size: As required to meet required acoustical performance.
4. Panel Thickness: As required to meet required acoustical performance.
5. Edges: Perimeter edges reinforced by a formulated resin hardener.
6. Fabric:
7. Color: As indicated.

D. Fabric-Covered Acoustical Ceiling Baffles:

1. Baffle Core: Manufacturer's standard rigid or semi-rigid fiberglass core.

2.02 WOOD VENEER SOUND-ABSORBING UNITS

A. Manufacturers:

1. Murano Acoustics USA, by Bartley Group, Inc: www.muranoacoustics.us/#sle.
2. RPG Diffusor Systems, Inc: www.rpginc.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

B. Wood Veneer Acoustical Panels for Walls and Ceilings: Medium Density Fiberboard (MDF) core panels with prime grade finished face veneer and non-woven acoustic material adhered to back of panel.

1. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
2. Noise Reduction Coefficient (NRC): 0.70 to 0.80 when tested in accordance with ASTM C423 for Type A mounting, per ASTM E795.
3. Acoustic Back-Up Material: Compressed fiberglass board, 1.5 lbs/cu ft (24 kgs/cu m) density, in sizes to fit furring applications.

a. Thickness: As required to comply with NRC requirements indicated.

4. Panel Thickness: 3/4 inch (19 mm), fire rated MDF substrate.
5. Provide MDF with no added urea formaldehyde (NAUF).
6. Mounting: Use fixing clips to attach to panels anchored to .
    a. Edge Profile:

2.03 MELAMINE FOAM SOUND-ARBORBING UNITS

A. Manufacturers:
    1. Pinta Acoustic Inc: www.pinta-acoustic.com/#sle.
    2. TECHLITE; Pyramid Panels: www.techlite.com/#sle.
    3. Substitutions: See Section 01 6000 - Product Requirements.
B. Melamine Foam Acoustical Panels for Walls and Ceilings: Open cell melamine-based foam.
    1. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
    2. Vinyl Composite Layer: Manufacturers standard mass loaded vinyl bonded to melamine foam core.
    3. Panel Thickness: As required to meet required acoustical performance.
    4. Mounting: Direct applied with adhesive.
    5. Mounting: Lay-in panel for suspended ceiling system, exposed grid.
        a. Suspension System: Specified in Section 09 5100.

2.04 FABRICATION

A. Fabric Wrapped, General: Fabricate panels to sizes and configurations as indicated, with fabric facing installed without sagging, wrinkles, blisters, or visible seams.
    1. Where radiused or mitered corners are indicated, install fabric to avoid seams or gathering of material.
    2. For panels suspended from ceiling, provide fabric covering both sides, with seams only at panel edges.
B. Tolerances: Fabricate to finished tolerance of plus or minus 1/16 inch (1.6 mm) for thickness, overall length and width, and squareness from corner to corner.
C. Factory-applied finishes on wood veneer panels to be uniform, smooth, and without blemishes.

2.05 ACCESSORIES

A. Spline-Mounting Accessories: Manufacturer's standard concealed connecting splines of extruded aluminum designed for screw attachment to walls, with coordinating moldings and trim for interior and exterior corners and miscellaneous conditions.
    1. Color of Exposed Trim: As selected from manufacturer's standards.
B. Back-Mounting Accessories: Manufacturer's standard accessories for concealed support, designed to allow panel removal, and as follows:
    1. Two-part clip and base-support bracket system; brackets designed to support full weight of panels and clips designed for lateral support, with one part mechanically attached to back of panel and the other attached to substrate.

2. Metal impaling clips designed to support full weight of panels, mechanically attached to substrate and adhesively bonded to back of panels.
3. Hook and loop strips adhered to substrate and to back of panels.
4. Z-clip hanger and magnet system with magnets recessed into panel frame and designed to engage steel mounting plates secured to substrate with screws.
5. Mechanically Mounted Metal-Framed Panels: Metal panel-clip system designed to engage metal framing of panels.

C. Ceiling-Suspended Accessories: Manufacturer's standard accessories at locations as indicated on each acoustical unit, sized appropriately for weight of acoustical unit.
1. Through-threaded eyelets bolted through concealed perimeter frame.
2. Stainless steel spiral hangers screwed into top edge of baffle.
3. S-hook attached through grommets.
4. Provide support for suspension from ceiling at heights as indicated.

D. Fixing Clips: Manufacturers standard for application as indicated.

E. Furring Strips: 1 by 2 inch wood furring (25 by 50 mm).

F. Panel Adhesive: Acceptable to acoustical panel manufacturer for application as indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates for conditions detrimental to installation of acoustical units. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install acoustical units in locations as indicated, following manufacturer's installation instructions.

B. Align panels accurately, with edges plumb and top edges level. Scribe to fit accurately at adjoining work and penetrations.

C. Suspend ceiling baffles at locations and heights as indicated.

D. Furring Mounted Wood Veneer Panels:
1. Install furring strip along meeting edges of adjacent panels to ensure they are attached to same furring strip along abutted edge; 24 inch (610 mm) on center, maximum.
2. Install acoustic back-up material between furring as required for application.
3. Adhere first panel from edge to furring strip, and attach subsequent panels using fixing clips.

E. Install acoustical units to construction tolerances of plus or minus 1/16 inch (1.6 mm) for the following:
1. Plumb and level.
2. Flatness.

3.03 CLEANING

A. Clean fabric facing upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

3.04 PROTECTION

A. Provide protection of installed acoustical panels until Date of Substantial Completion.

B. Replace panels that cannot be cleaned and repaired to satisfaction of the Architect.

END OF SECTION

SECTION 09 9000
PAINTING AND COATING - COMMERCIAL GUIDE SPEC

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PART 1 GENERAL

2.01 SECTION INCLUDES

A. Surface preparation and field painting of exposed interior items and surfaces.

B. Surface preparation and field painting of exposed exterior items and surfaces.

C. Surface preparation and field application of interior high-performance coating systems to items and surfaces scheduled.

D. Surface preparation and field application of exterior high-performance coating systems to items and surfaces scheduled.

E. Painting of exposed bare and covered pipes and ducts, hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.

2.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

B. Section 05 1200 - Structural Steel Framing.

C. Section 05 5000 - Metal Fabrications.

D. Section 06 2000 - Finish Carpentry: Shop priming architectural woodwork.

E. Section 08 1113 - Hollow Metal Doors and Frames.

F. Section 09 2116 - Gypsum Board Assemblies.

2.03 DEFINITIONS

A. General: Standard coating terms defined in ASTM D16.

1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85 degree meter.

2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60 degree meter.

3. Semi-Gloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60 degree meter.

4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60 degree meter.

B. Environments: The following terms distinguish between different corrosive exposures:

1. "Severe environments" are highly corrosive industrial atmospheres with sustained exposure to high humidity and condensation and with frequent cleaning using strong chemicals. Environments with heavy concentrations of strong chemical fumes and frequent splashing and spilling of harsh chemical products are severe environments.

2. "Moderate environments" are corrosive industrial atmospheres with intermittent exposure to high humidity and condensation, occasional mold and mildew development, and regular cleaning with strong chemicals. Environments with exposure to heavy concentrations of chemical fumes and occasional splashing and spilling of chemical products are moderate environments.

3. "Mild environments" are industrial atmospheres with normal exposure to moderate humidity and condensation, occasional mold and mildew development, and infrequent cleaning with strong chemicals. Environments with low levels of mild chemical fumes and occasional splashing and spilling of chemical products are mild environments. Normal outdoor weathering is also considered a mild environment.

2.04 REFERENCE STANDARDS

A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2016.

B. SSPC-SP 6 - Commercial Blast Cleaning 2007.

2.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: For each paint system indicated, including:

1. Material List: An inclusive list of required coating materials. Indicate each material and cross reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.

2. Preparation instructions and recommendations.

3. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

2.06 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this project, whose work has resulted in applications with a record of successful in-service performance.

B. Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

C. Paint exposed surfaces. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.

D. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

E. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.

2. Finish areas designated by Architect.

3. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.

4. Refinish mock-up area as required to produce acceptable work.

2.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 degrees F (7 degrees C). Maintain storage containers in a clean condition, free of foreign materials and residue.

2.08 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside

manufacturer's absolute limits.

B. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 degrees F (10 degrees C) and 90 degrees F (32 degrees C).

C. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 degrees F (7 degrees C) and 95 degrees F (35 degrees C).

D. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 degrees F (3 degrees C) above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

2.09 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.

B. Quantity: Furnish Owner with an additional three percent, but not less than 1 gallon (3.8 l) or 1 case, as appropriate, of each material and color applied.

PART 2 PRODUCTS

3.01 MANUFACTURERS

A. Basis of Design Manufacturer: PPG Paints, 400 Bertha Lamme Drive Cranberry, PA 16066. Toll Free Tel: 888-PPG-IDEA. Web: www.ppgpaints.com/#sle.

B. Other Acceptable Manufacturers:

1. [_____] .

2. [_____].

3. Substitutions: See Section 01 6000 - Product Requirements.

3.02 PAINT MATERIALS - GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. VOC Classification: Provide high-performance coating materials, including primers, undercoats, and finish-coat materials, that meet the applicable local, state or federal VOC requirements.

C. Color: Refer to Finish Schedule and Paint Legend for paint colors.

PART 3 EXECUTION

4.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Coordination of Work: Review other sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

2. If a potential incompatibility of primers applied by others exists, obtain the following from the primer applicator before proceeding:
    a. Confirmation of primer's suitability for expected service conditions.
    b. Confirmation of primer's ability to be top coated with materials specified.

4.02 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
    1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each substrate condition and as specified.
    1. Provide barrier coats over incompatible primers or remove and reprime.
    2. Cementitious Substrates: Prepare concrete, brick, concrete masonry block, and cement plaster surfaces to be coated. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods to prepare surfaces.
        a. Use abrasive blast-cleaning methods if recommended by coating manufacturer.
        b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not coat surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
    3. Wood Substrates: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Smoothly sand surfaces exposed to view and dust off.
        a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer, before applying primer.
        b. Immediately on delivery, prime edges, ends, faces, undersides, and backsides of wood to be coated.
        c. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
    4. Ferrous Metal Substrates: Clean ungalvanized ferrous metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC recommendations.
        a. Blast-clean steel surfaces as recommended by coating manufacturer and according to SSPC-SP 6.
        b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
        c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire brush, solvent clean, and touch up with same primer as the shop coat.

5. Non-Ferrous Metal Substrates: Clean non-ferrous and galvanized surfaces according to manufacturer's written instructions for the type of service, metal substrate, and application required.
    a. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

D. Material Preparation: Carefully mix and prepare coating materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying coatings in a clean condition, free of foreign materials and residue.
2. Stir materials before applying to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into the material. Remove film and, if necessary, strain coating material before using.
3. Use only the type of thinners approved by manufacturer and only within recommended limits.
4. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

4.03 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

B. General: Apply high-performance coatings according to manufacturer's written instructions.

1. Use applicators and techniques best suited for the material being applied.
2. Do not apply high-performance coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.
3. Coating surface treatments and finishes are indicated in the coating system descriptions.
4. Provide finish coats compatible with primers used.
5. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, grilles, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.

C. Application Procedures: Apply coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. The number of coats and film thickness required is the same regardless of application method.
2. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or recoat work that does not comply with specified requirements.

4.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection and testing.

B. Owner reserves the right to invoke the following test procedure at any time and as often as Owner deems necessary during the period when paint is being applied:

1. Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to project will be taken, identified, sealed, and certified in the presence of Contractor.
2. Owner may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove noncomplying paint from project site,

pay for testing, and repaint surfaces previously coated with the noncomplying paint. If necessary, Contractor may be required to remove noncomplying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

4.05 CLEANING

A. After completing painting, clean glass and paint spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

4.06 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.

C. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces.

END OF SECTION

SECTION 09 9000
PAINTING AND COATING - LEED V4/GREEN PRODUCT GUIDE SPEC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation and field painting of exposed interior items and surfaces.

B. Surface preparation and field painting of exposed exterior items and surfaces.

C. Surface preparation and field application of interior high-performance coating systems to items and surfaces scheduled.

D. Surface preparation and field application of exterior high-performance coating systems to items and surfaces scheduled.

E. Painting of exposed bare and covered pipes and ducts, hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.

1.02 DEFINITIONS

A. General: Standard coating terms defined in ASTM D16.

1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85 degree meter.

2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60 degree meter.

3. Semi-Gloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60 degree meter.

4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60 degree meter.

B. Environments: The following terms distinguish between different corrosive exposures:

1. "Severe environments" are highly corrosive industrial atmospheres with sustained exposure to high humidity and condensation and with frequent cleaning using strong chemicals. Environments with heavy concentrations of strong chemical fumes and frequent splashing and spilling of harsh chemical products are severe environments.

2. "Moderate environments" are corrosive industrial atmospheres with intermittent exposure to high humidity and condensation, occasional mold and mildew development, and regular cleaning with strong chemicals. Environments with exposure to heavy concentrations of chemical fumes and occasional splashing and spilling of chemical products are moderate environments.

3. "Mild environments" are industrial atmospheres with normal exposure to moderate humidity and condensation, occasional mold and mildew development, and infrequent cleaning with strong chemicals. Environments with low levels of mild chemical fumes and occasional splashing and spilling of chemical products are mild environments. Normal outdoor weathering is also considered a mild environment.

1.03 REFERENCE STANDARDS

A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2016.

B. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers 2017, v1.2.

C. EN 15804 - Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products 2013.

D. ISO 14025 - Environmental labels and declarations -- Type III environmental declarations -- Principles and procedures 2006.

E. ISO 14040 - Environmental management -- Life cycle assessment -- Principles and framework 2006.

F. ISO 14044 - Environmental management -- Life cycle assessment -- Requirements and guidelines 2006.

G. ISO 21930 - Sustainability in buildings and civil engineering works -- Core rules for environmental product declarations of construction products and services 2017.

H. SSPC-SP 6 - Commercial Blast Cleaning 2007.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: For each paint system indicated, including:

1. Material List: An inclusive list of required coating materials. Indicate each material and cross reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.

2. Preparation instructions and recommendations.

3. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

D. Verification Samples: For each finish product specified, two samples, minimum size 6 inch (150 mm) square, representing actual product, color, and patterns.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this project, whose work has resulted in applications with a record of successful in-service performance.

B. Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

C. Paint exposed surfaces. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.

D. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

E. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.

2. Finish areas designated by Architect.

3. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.

4. Refinish mock-up area as required to produce acceptable work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 degrees F (7 degrees C). Maintain storage containers in a clean condition, free of

foreign materials and residue.

1.07 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 degrees F (10 degrees C) and 90 degrees F (32 degrees C).

C. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 degrees F (7 degrees C) and 95 degrees F (35 degrees C).

D. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 degrees F (3 degrees C) above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.08 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.

B. Quantity: Furnish Owner with an additional three percent, but not less than 1 gallon (3.8 l) or 1 case, as appropriate, of each material and color applied.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer: PPG Paints, 400 Bertha Lamme Drive Cranberry, PA 16066. Toll Free Tel: 888-PPG-IDEA. Web: www.ppgpaints.com/#sle.

2.02 PAINT MATERIALS - GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. VOC Classification: Provide high-performance coating materials, including primers, undercoats, and finish-coat materials, that meet the applicable local, state or federal VOC requirements.

C. LEED v4 EQ Credit: Low Emitting Materials, VOC Limits:

1. Interior Applications: For LEED v4 Compliance, 100 percent of paint and coatings products by volume applied to the interior must comply with the wet applied VOC content limits.

2. Exterior Applications (Schools and Healthcare Only): For LEED v4 Compliance, 90 percent of paint and coatings products by volume applied to the exterior must comply with the wet applied VOC content limits.

Table of Commonly Used Coatings VOC Limits		
Coating Category	CARB 2007 SCM VOC Limit	SCAQMD R1113, 6/3/11 VOC Limit
Flats	50 g/L	50 g/L
Non-Flats	100 g/L	50 g/L
Non-Flat, high Gloss	150 g/L	50 g/L

Primers, Sealers & Undercoaters	100 g/L	100 g/L
Floor Coatings	100 g/L	50 g/L
Industrial Maintenance Coatings	250 g/L	100 g/L
Rust Preventive Coatings	250 g/L	100 g/L
Stains, Exterior	250 g/L	100 g/L

D. LEED v4 EQ Credit: Low Emitting Materials, Emissions Requirement:

1. Interior Applications: For LEED v4 compliance, 90 percent of paint and coatings products by volume applied to the interior must comply with emissions requirements.

2. To demonstrate compliance, a product or layer containing paint must meet the following requirement, as applicable, with regard to emissions:

a. General Emissions Evaluation: Building products must be tested and determined compliant in accordance with CAL (CDPH SM) , using the applicable exposure scenario. The default scenario is the private office scenario. The manufacturers or third-party certification must state the exposure scenario used to determine compliance. Claims of compliance for wet-applied products must state the amount applied in mass per surface area.

b. Manufacturers' claims of compliance with the above requirements must also state the range of total VOCs after 14 days (336 hours), measured as specified in CAL (CDPH SM):

1) 0.5 mg/m3 or less.

2) Between 0.5 and 5.0 mg/m3.

3) 5.0 mg/m3 or more.

E. LEED v4 MR Credit: Building Product Disclosure and Optimization—Environmental Product Declarations.

1. Option 1. Environmental Product Declaration (EPD) (1 point): Use at least 20 different permanently installed products sourced from at least five different manufacturers that meet one of the disclosure criteria below.

a. Environmental Product Declarations which conform to ISO 14025, ISO 14040, ISO 14044 and EN 15804 or ISO 21930 and have at least a cradle to gate scope.

b. Product Specific Type III EPD -- Products with third-party certification (Type III), including external verification in which the manufacturer is explicitly recognized as the participant by the program operator are valued as one whole product for purposes of credit achievement calculation.

c. For credit achievement calculation, products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.

F. LEED v4 MR Credit: Building Product Disclosure and Optimization--Material Ingredients

1. Option 1. Material Ingredient Reporting (1 point): Use at east 20 different permanently installed products from at least five different manufacturers that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1 percent (1000 ppm).

a. Health Product Declaration (HPD). The end use product has a published, complete Health Product Declaration with full disclosure of known hazards in compliance with the Health Product Declaration open Standard.

G. Color: Refer to Finish Schedule and Paint Legend for paint colors.

2.03 CONCRETE MASONRY UNIT BLOCK FILLER

A. Basis of design - PPG Paints select seal grip types for the appropriate surfaces.

B. Concrete Masonry Unit Block Filler: Factory formulated high-performance latex block fillers.

2.04 INTERIOR PRIMERS

A. Basis of design - PPG Paints select seal grip types for the appropriate surfaces.

B. Interior Concrete and Masonry Primer: Factory-formulated alkali-resistant acrylic-latex interior primer for interior application.

C. Interior Gypsum Board Primer: Factory-formulated latex-based primer for interior application.

D. Interior Wood Primer: Factory-formulated acrylic-latex-based interior wood primer.

E. Interior Ferrous, Non-Ferrous, Galvanized Metal, and Aluminum Primer: Factory-formulated acrylic water-based rust-inhibitive metal primer.

2.05 EXTERIOR PRIMERS

A. Basis of design - PPG Paints select seal grip types for the appropriate surfaces.

B. Exterior Concrete and Masonry Primer: Factory-formulated alkali-resistant acrylic-latex primer for exterior application.

C. Exterior Gypsum Soffit Board Primer: Factory-formulated latex-based primer for exterior application.

D. Exterior Wood Primer for Acrylic Enamels: Factory-formulated latex wood primer for exterior application.

2.06 INTERIOR FINISH COATS

A. Basis of design - PPG Paints select seal grip types for the appropriate surfaces.

B. Interior Flat Latex: Factory-formulated flat acrylic latex-based interior paint.

C. Interior Eggshell Acrylic Enamel: Factory-formulated eggshell acrylic-latex interior enamel.

D. Interior Satin Acrylic Enamel: Factory-formulated satin acrylic-latex interior enamel.

E. Interior Semi-Gloss Acrylic Enamel: Factory-formulated semi-gloss acrylic-latex enamel.

F. Interior Full-Gloss Acrylic Enamel: Factory-formulated full-gloss acrylic-latex interior enamel.

G. Interior Eggshell Water Borne Acrylic Epoxy:

H. Interior Semi-Gloss Water Borne Acrylic Epoxy:

I. Interior Flat Waterborne Acrylic Dry Fog:

J. Interior Semi-Gloss Waterborne Acrylic Dry Fog:

K. Interior/Exterior High Performance Satin Polysiloxane:

2.07 EXTERIOR FINISH COATS

A. Basis of design - PPG Paints select seal grip types for the appropriate surfaces.

B. Exterior Flat Acrylic Paint: Factory-formulated flat acrylic-emulsion latex paint for exterior application.

C. Exterior Satin Acrylic Paint: Factory-formulated satin acrylic-latex paint for exterior application.

D. Exterior Semi-Gloss Acrylic Paint: Factory-formulated semi-gloss waterborne acrylic-latex enamel for exterior application.

E. Exterior Full-Gloss Acrylic Enamel: Factory-formulated full-gloss waterborne acrylic-latex enamel for exterior application.

F. Exterior High Performance Satin Polysiloxane:

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Coordination of Work: Review other sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

2. If a potential incompatibility of primers applied by others exists, obtain the following from the primer applicator before proceeding:

a. Confirmation of primer's suitability for expected service conditions.

b. Confirmation of primer's ability to be top coated with materials specified.

3.02 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.

2. Cementitious Substrates: Prepare concrete, brick, concrete masonry block, and cement plaster surfaces to be coated. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods to prepare surfaces.

a. Use abrasive blast-cleaning methods if recommended by coating manufacturer.

b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not coat surfaces if moisture content exceeds that permitted in manufacturer's written instructions.

3. Wood Substrates: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Smoothly sand surfaces exposed to view and dust off.

a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer, before applying primer.

b. Immediately on delivery, prime edges, ends, faces, undersides, and backsides of wood to be coated.

c. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

4. Ferrous Metal Substrates: Clean ungalvanized ferrous metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC recommendations.

   a. Blast-clean steel surfaces as recommended by coating manufacturer and according to SSPC-SP 6.

   b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.

   c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire brush, solvent clean, and touch up with same primer as the shop coat.

5. Non-Ferrous Metal Substrates: Clean non-ferrous and galvanized surfaces according to manufacturer's written instructions for the type of service, metal substrate, and application required.

   a. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

D. Material Preparation: Carefully mix and prepare coating materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying coatings in a clean condition, free of foreign materials and residue.

2. Stir materials before applying to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into the material. Remove film and, if necessary, strain coating material before using.

3. Use only the type of thinners approved by manufacturer and only within recommended limits.

4. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.03 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

B. General: Apply high-performance coatings according to manufacturer's written instructions.

1. Use applicators and techniques best suited for the material being applied.

2. Do not apply high-performance coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.

3. Coating surface treatments and finishes are indicated in the coating system descriptions.

4. Provide finish coats compatible with primers used.

5. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, grilles, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.

C. Application Procedures: Apply coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. The number of coats and film thickness required is the same regardless of application method.

2. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or recoat work that does not comply with specified requirements.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection and testing.

B. Owner reserves the right to invoke the following test procedure at any time and as often as Owner deems necessary during the period when paint is being applied:

3.05 CLEANING

A. After completing painting, clean glass and paint spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.06 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.

C. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces.

END OF SECTION

SECTION 09 9000
PAINTING AND COATING - LEED V4/GREEN PRODUCT GUIDE SPEC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation and field painting of exposed interior items and surfaces.

B. Surface preparation and field painting of exposed exterior items and surfaces.

C. Surface preparation and field application of interior high-performance coating systems to items and surfaces scheduled.

D. Surface preparation and field application of exterior high-performance coating systems to items and surfaces scheduled.

E. Painting of exposed bare and covered pipes and ducts, hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.

1.02 DEFINITIONS

A. General: Standard coating terms defined in ASTM D16.

1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85 degree meter.

2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60 degree meter.

3. Semi-Gloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60 degree meter.

4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60 degree meter.

B. Environments: The following terms distinguish between different corrosive exposures:

1. "Severe environments" are highly corrosive industrial atmospheres with sustained exposure to high humidity and condensation and with frequent cleaning using strong chemicals. Environments with heavy concentrations of strong chemical fumes and frequent splashing and spilling of harsh chemical products are severe environments.

2. "Moderate environments" are corrosive industrial atmospheres with intermittent exposure to high humidity and condensation, occasional mold and mildew development, and regular cleaning with strong chemicals. Environments with exposure to heavy concentrations of chemical fumes and occasional splashing and spilling of chemical products are moderate environments.

3. "Mild environments" are industrial atmospheres with normal exposure to moderate humidity and condensation, occasional mold and mildew development, and infrequent cleaning with strong chemicals. Environments with low levels of mild chemical fumes and occasional splashing and spilling of chemical products are mild environments. Normal outdoor weathering is also considered a mild environment.

1.03 REFERENCE STANDARDS

A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2016.

B. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers 2017, v1.2.

C. EN 15804 - Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products 2013.

D. ISO 14025 - Environmental labels and declarations -- Type III environmental declarations -- Principles and procedures 2006.

E. ISO 14040 - Environmental management -- Life cycle assessment -- Principles and framework 2006.

F. ISO 14044 - Environmental management -- Life cycle assessment -- Requirements and guidelines 2006.

G. ISO 21930 - Sustainability in buildings and civil engineering works -- Core rules for environmental product declarations of construction products and services 2017.

H. SSPC-SP 6 - Commercial Blast Cleaning 2007.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: For each paint system indicated, including:

1. Material List: An inclusive list of required coating materials. Indicate each material and cross reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.

2. Preparation instructions and recommendations.

3. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

D. Verification Samples: For each finish product specified, two samples, minimum size 6 inch (150 mm) square, representing actual product, color, and patterns.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this project, whose work has resulted in applications with a record of successful in-service performance.

B. Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

C. Paint exposed surfaces. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.

D. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

E. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.

2. Finish areas designated by Architect.

3. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.

4. Refinish mock-up area as required to produce acceptable work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 degrees F (7 degrees C). Maintain storage containers in a clean condition, free of

foreign materials and residue.

1.07 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 degrees F (10 degrees C) and 90 degrees F (32 degrees C).

C. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 degrees F (7 degrees C) and 95 degrees F (35 degrees C).

D. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 degrees F (3 degrees C) above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.08 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.

B. Quantity: Furnish Owner with an additional three percent, but not less than 1 gallon (3.8 l) or 1 case, as appropriate, of each material and color applied.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer: PPG Paints, 400 Bertha Lamme Drive Cranberry, PA 16066. Toll Free Tel: 888-PPG-IDEA. Web: www.ppgpaints.com/#sle.

2.02 PAINT MATERIALS - GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. VOC Classification: Provide high-performance coating materials, including primers, undercoats, and finish-coat materials, that meet the applicable local, state or federal VOC requirements.

C. LEED v4 EQ Credit: Low Emitting Materials, VOC Limits:

1. Interior Applications: For LEED v4 Compliance, 100 percent of paint and coatings products by volume applied to the interior must comply with the wet applied VOC content limits.

2. Exterior Applications (Schools and Healthcare Only): For LEED v4 Compliance, 90 percent of paint and coatings products by volume applied to the exterior must comply with the wet applied VOC content limits.

Table of Commonly Used Coatings VOC Limits		
Coating Category	CARB 2007 SCM VOC Limit	SCAQMD R1113, 6/3/11 VOC Limit
Flats	50 g/L	50 g/L
Non-Flats	100 g/L	50 g/L
Non-Flat, high Gloss	150 g/L	50 g/L

Primers, Sealers & Undercoaters	100 g/L	100 g/L
Floor Coatings	100 g/L	50 g/L
Industrial Maintenance Coatings	250 g/L	100 g/L
Rust Preventive Coatings	250 g/L	100 g/L
Stains, Exterior	250 g/L	100 g/L

D. LEED v4 EQ Credit: Low Emitting Materials, Emissions Requirement:

1. Interior Applications: For LEED v4 compliance, 90 percent of paint and coatings products by volume applied to the interior must comply with emissions requirements.

2. To demonstrate compliance, a product or layer containing paint must meet the following requirement, as applicable, with regard to emissions:

a. General Emissions Evaluation: Building products must be tested and determined compliant in accordance with CAL (CDPH SM) , using the applicable exposure scenario. The default scenario is the private office scenario. The manufacturers or third-party certification must state the exposure scenario used to determine compliance. Claims of compliance for wet-applied products must state the amount applied in mass per surface area.

b. Manufacturers' claims of compliance with the above requirements must also state the range of total VOCs after 14 days (336 hours), measured as specified in CAL (CDPH SM):

1) 0.5 mg/m3 or less.

2) Between 0.5 and 5.0 mg/m3.

3) 5.0 mg/m3 or more.

E. LEED v4 MR Credit: Building Product Disclosure and Optimization—Environmental Product Declarations.

1. Option 1. Environmental Product Declaration (EPD) (1 point): Use at least 20 different permanently installed products sourced from at least five different manufacturers that meet one of the disclosure criteria below.

a. Environmental Product Declarations which conform to ISO 14025, ISO 14040, ISO 14044 and EN 15804 or ISO 21930 and have at least a cradle to gate scope.

b. Product Specific Type III EPD -- Products with third-party certification (Type III), including external verification in which the manufacturer is explicitly recognized as the participant by the program operator are valued as one whole product for purposes of credit achievement calculation.

c. For credit achievement calculation, products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200 percent of their base contributing cost.

F. LEED v4 MR Credit: Building Product Disclosure and Optimization--Material Ingredients

1. Option 1. Material Ingredient Reporting (1 point): Use at east 20 different permanently installed products from at least five different manufacturers that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1 percent (1000 ppm).

a. Health Product Declaration (HPD). The end use product has a published, complete Health Product Declaration with full disclosure of known hazards in compliance with the Health Product Declaration open Standard.

G. Color: Refer to Finish Schedule and Paint Legend for paint colors.

2.03 CONCRETE MASONRY UNIT BLOCK FILLER

A. Basis of design - PPG Paints select seal grip types for the appropriate surfaces.

B. Concrete Masonry Unit Block Filler: Factory formulated high-performance latex block fillers.

2.04 INTERIOR PRIMERS

A. Basis of design - PPG Paints select seal grip types for the appropriate surfaces.

B. Interior Concrete and Masonry Primer: Factory-formulated alkali-resistant acrylic-latex interior primer for interior application.

C. Interior Gypsum Board Primer: Factory-formulated latex-based primer for interior application.

D. Interior Wood Primer: Factory-formulated acrylic-latex-based interior wood primer.

E. Interior Ferrous, Non-Ferrous, Galvanized Metal, and Aluminum Primer: Factory-formulated acrylic water-based rust-inhibitive metal primer.

2.05 EXTERIOR PRIMERS

A. Basis of design - PPG Paints select seal grip types for the appropriate surfaces.

B. Exterior Concrete and Masonry Primer: Factory-formulated alkali-resistant acrylic-latex primer for exterior application.

C. Exterior Gypsum Soffit Board Primer: Factory-formulated latex-based primer for exterior application.

D. Exterior Wood Primer for Acrylic Enamels: Factory-formulated latex wood primer for exterior application.

2.06 INTERIOR FINISH COATS

A. Basis of design - PPG Paints select seal grip types for the appropriate surfaces.

B. Interior Flat Latex: Factory-formulated flat acrylic latex-based interior paint.

C. Interior Eggshell Acrylic Enamel: Factory-formulated eggshell acrylic-latex interior enamel.

D. Interior Satin Acrylic Enamel: Factory-formulated satin acrylic-latex interior enamel.

E. Interior Semi-Gloss Acrylic Enamel: Factory-formulated semi-gloss acrylic-latex enamel.

F. Interior Full-Gloss Acrylic Enamel: Factory-formulated full-gloss acrylic-latex interior enamel.

G. Interior Eggshell Water Borne Acrylic Epoxy:

H. Interior Semi-Gloss Water Borne Acrylic Epoxy:

I. Interior Flat Waterborne Acrylic Dry Fog:

J. Interior Semi-Gloss Waterborne Acrylic Dry Fog:

K. Interior/Exterior High Performance Satin Polysiloxane:

2.07 EXTERIOR FINISH COATS

A. Basis of design - PPG Paints select seal grip types for the appropriate surfaces.

B. Exterior Flat Acrylic Paint: Factory-formulated flat acrylic-emulsion latex paint for exterior application.

C. Exterior Satin Acrylic Paint: Factory-formulated satin acrylic-latex paint for exterior application.

D. Exterior Semi-Gloss Acrylic Paint: Factory-formulated semi-gloss waterborne acrylic-latex enamel for exterior application.

E. Exterior Full-Gloss Acrylic Enamel: Factory-formulated full-gloss waterborne acrylic-latex enamel for exterior application.

F. Exterior High Performance Satin Polysiloxane:

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Coordination of Work: Review other sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

2. If a potential incompatibility of primers applied by others exists, obtain the following from the primer applicator before proceeding:

a. Confirmation of primer's suitability for expected service conditions.

b. Confirmation of primer's ability to be top coated with materials specified.

3.02 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.

2. Cementitious Substrates: Prepare concrete, brick, concrete masonry block, and cement plaster surfaces to be coated. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods to prepare surfaces.

a. Use abrasive blast-cleaning methods if recommended by coating manufacturer.

b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not coat surfaces if moisture content exceeds that permitted in manufacturer's written instructions.

3. Wood Substrates: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Smoothly sand surfaces exposed to view and dust off.

a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer, before applying primer.

b. Immediately on delivery, prime edges, ends, faces, undersides, and backsides of wood to be coated.

c. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

4. Ferrous Metal Substrates: Clean ungalvanized ferrous metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC recommendations.

   a. Blast-clean steel surfaces as recommended by coating manufacturer and according to SSPC-SP 6.

   b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.

   c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire brush, solvent clean, and touch up with same primer as the shop coat.

5. Non-Ferrous Metal Substrates: Clean non-ferrous and galvanized surfaces according to manufacturer's written instructions for the type of service, metal substrate, and application required.

   a. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

D. Material Preparation: Carefully mix and prepare coating materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying coatings in a clean condition, free of foreign materials and residue.

2. Stir materials before applying to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into the material. Remove film and, if necessary, strain coating material before using.

3. Use only the type of thinners approved by manufacturer and only within recommended limits.

4. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.03 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

B. General: Apply high-performance coatings according to manufacturer's written instructions.

1. Use applicators and techniques best suited for the material being applied.

2. Do not apply high-performance coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.

3. Coating surface treatments and finishes are indicated in the coating system descriptions.

4. Provide finish coats compatible with primers used.

5. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, grilles, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.

C. Application Procedures: Apply coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. The number of coats and film thickness required is the same regardless of application method.

2. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or recoat work that does not comply with specified requirements.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection and testing.

B. Owner reserves the right to invoke the following test procedure at any time and as often as Owner deems necessary during the period when paint is being applied:

1. Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to project will be taken, identified, sealed, and certified in the presence of Contractor.

2. Owner may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove noncomplying paint from project site, pay for testing, and repaint surfaces previously coated with the noncomplying paint. If necessary, Contractor may be required to remove noncomplying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

3.05 CLEANING

A. After completing painting, clean glass and paint spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.06 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.

C. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces.

END OF SECTION

SECTION 09 9000
PAINTING AND COATING - COMMERCIAL GUIDE SPEC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation and field painting of exposed interior items and surfaces.

B. Surface preparation and field painting of exposed exterior items and surfaces.

C. Surface preparation and field application of interior high-performance coating systems to items and surfaces scheduled.

D. Surface preparation and field application of exterior high-performance coating systems to items and surfaces scheduled.

E. Painting of exposed bare and covered pipes and ducts, hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

B. Section 05 1200 - Structural Steel Framing.

C. Section 05 5000 - Metal Fabrications.

D. Section 06 2000 - Finish Carpentry: Shop priming architectural woodwork.

E. Section 08 1113 - Hollow Metal Doors and Frames.

F. Section 09 2116 - Gypsum Board Assemblies.

1.03 DEFINITIONS

A. General: Standard coating terms defined in ASTM D16.

1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85 degree meter.

2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60 degree meter.

3. Semi-Gloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60 degree meter.

4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60 degree meter.

B. Environments: The following terms distinguish between different corrosive exposures:

1. "Severe environments" are highly corrosive industrial atmospheres with sustained exposure to high humidity and condensation and with frequent cleaning using strong chemicals. Environments with heavy concentrations of strong chemical fumes and frequent splashing and spilling of harsh chemical products are severe environments.

2. "Moderate environments" are corrosive industrial atmospheres with intermittent exposure to high humidity and condensation, occasional mold and mildew development, and regular cleaning with strong chemicals. Environments with exposure to heavy concentrations of chemical fumes and occasional splashing and spilling of chemical products are moderate environments.

3. "Mild environments" are industrial atmospheres with normal exposure to moderate humidity and condensation, occasional mold and mildew development, and infrequent cleaning with strong chemicals. Environments with low levels of mild chemical fumes and occasional splashing and

spilling of chemical products are mild environments. Normal outdoor weathering is also considered a mild environment.

1.04 REFERENCE STANDARDS

A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2016.

B. SSPC-SP 6 - Commercial Blast Cleaning 2007.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: For each paint system indicated, including:

1. Material List: An inclusive list of required coating materials. Indicate each material and cross reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Preparation instructions and recommendations.
3. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this project, whose work has resulted in applications with a record of successful in-service performance.

B. Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

C. Paint exposed surfaces. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.

D. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

E. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.
2. Finish areas designated by Architect.
3. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
4. Refinish mock-up area as required to produce acceptable work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 degrees F (7 degrees C). Maintain storage containers in a clean condition, free of foreign materials and residue.

1.08 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 degrees F (10 degrees C) and 90 degrees F (32 degrees C).

C. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 degrees F (7 degrees C) and 95 degrees F (35 degrees C).

D. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 degrees F (3 degrees C) above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.09 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.

B. Quantity: Furnish Owner with an additional three percent, but not less than 1 gallon (3.8 l) or 1 case, as appropriate, of each material and color applied.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer: PPG Paints, 400 Bertha Lamme Drive Cranberry, PA 16066. Toll Free Tel: 888-PPG-IDEA. Web: www.ppgpaints.com/#sle.

B. Other Acceptable Manufacturers:

1. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINT MATERIALS - GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. VOC Classification: Provide high-performance coating materials, including primers, undercoats, and finish-coat materials, that meet the applicable local, state or federal VOC requirements.

C. Color: Refer to Finish Schedule and Paint Legend for paint colors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Coordination of Work: Review other sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

2. If a potential incompatibility of primers applied by others exists, obtain the following from the primer applicator before proceeding:

a. Confirmation of primer's suitability for expected service conditions.

b. Confirmation of primer's ability to be top coated with materials specified.

3.02 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.
2. Cementitious Substrates: Prepare concrete, brick, concrete masonry block, and cement plaster surfaces to be coated. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods to prepare surfaces.
    a. Use abrasive blast-cleaning methods if recommended by coating manufacturer.
    b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not coat surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
3. Wood Substrates: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Smoothly sand surfaces exposed to view and dust off.
    a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer, before applying primer.
    b. Immediately on delivery, prime edges, ends, faces, undersides, and backsides of wood to be coated.
    c. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
4. Ferrous Metal Substrates: Clean ungalvanized ferrous metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC recommendations.
    a. Blast-clean steel surfaces as recommended by coating manufacturer and according to SSPC-SP 6.
    b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
    c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire brush, solvent clean, and touch up with same primer as the shop coat.
5. Non-Ferrous Metal Substrates: Clean non-ferrous and galvanized surfaces according to manufacturer's written instructions for the type of service, metal substrate, and application required.

a. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

D. Material Preparation: Carefully mix and prepare coating materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying coatings in a clean condition, free of foreign materials and residue.

2. Stir materials before applying to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into the material. Remove film and, if necessary, strain coating material before using.

3. Use only the type of thinners approved by manufacturer and only within recommended limits.

4. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.03 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

B. General: Apply high-performance coatings according to manufacturer's written instructions.

1. Use applicators and techniques best suited for the material being applied.

2. Do not apply high-performance coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.

3. Coating surface treatments and finishes are indicated in the coating system descriptions.

4. Provide finish coats compatible with primers used.

5. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, grilles, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.

C. Application Procedures: Apply coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. The number of coats and film thickness required is the same regardless of application method.

2. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or recoat work that does not comply with specified requirements.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection and testing.

B. Owner reserves the right to invoke the following test procedure at any time and as often as Owner deems necessary during the period when paint is being applied:

1. Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to project will be taken, identified, sealed, and certified in the presence of Contractor.

2. Owner may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove noncomplying paint from project site, pay for testing, and repaint surfaces previously coated with the noncomplying paint. If necessary, Contractor may be required to remove noncomplying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

3.05 CLEANING

A. After completing painting, clean glass and paint spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.06 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.

C. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces.

END OF SECTION

SECTION 09 9113
EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Materials for backpriming woodwork.

D. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:

1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
2. Exposed surfaces of steel lintels and ledge angles.

E. Do Not Paint or Finish the Following Items:

1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
2. Items indicated to receive other finishes.
3. Items indicated to remain unfinished.
4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
5. Non-metallic roofing and flashing.
6. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, zinc, and lead.
7. Marble, granite, slate, and other natural stones.
8. Floors, unless specifically indicated.
9. Ceramic and other types of tiles.
10. Brick, glass unit masonry, architectural concrete, cast stone, integrally colored plaster and stucco as specified to be finished surfaces.
11. Exterior insulation and finish system (EIFS).
12. Glass.
13. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 09 9123 - Interior Painting.

1.03 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2016.

B. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating 2005 (Reapproved 2017).

C. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association Current Edition.

D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

E. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).

F. SSPC-SP 6 - Commercial Blast Cleaning 2007.

G. SSPC-SP 13 - Surface Preparation of Concrete 1997 (Reaffirmed 2003).

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").

2. MPI product number (e.g. MPI #47).

3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

4. Manufacturer's installation instructions.

5. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.

C. Samples: Submit two paper chip samples 1.5" x 2" in size illustrating range of colors and textures available for each surface finishing product scheduled.

D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

E. Manufacturer's Instructions: Indicate special surface preparation procedures.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer to the greatest extent possible.

1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
2. Substitution of MPI-approved products by a different manufacturer is preferred over substitution of unapproved products by the same manufacturer.
3. Substitution of a different paint system using MPI-approved products by the same manufacturer will be considered.

B. Paints:

1. Base Manufacturer:
2. Behr Process Corporation: www.behr.com/#sle.
3. Cloverdale Paint, Brand Products of Rodda Paint Company: www.cloverdalepaint.com/#sle.
4. PPG Paints: www.ppgpaints.com/#sle.
5. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

C. Primer Sealers: Same manufacturer as top coats.

D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.

1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.
2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
3. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
4. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
5. Supply each paint material in quantity required to complete entire project's work from a single production run.
6. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content: Comply with Section 01 6116.

C. Flammability: Comply with applicable code for surface burning characteristics.

D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

E. Colors: To be selected from manufacturer's full range of available colors.
   1. Selection to be made by Architect after award of contract.

2.03 PAINT SYSTEMS - EXTERIOR

A. Paint E-OP - Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including concrete, concrete masonry units, brick, fiber cement siding, primed wood and primed metal.
   1. Two top coats and one coat primer.
   2. Top Coat Sheen:
      a. Flat: MPI gloss level 1; use this sheen for overhead surfaces.
      b. Velvet: MPI gloss level 2; use this sheen at all locations.
      c. Eggshell: MPI gloss level 3; use this sheen at all locations.
      d. Satin: MPI gloss level 4; use this sheen at all locations.
      e. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
      f. Gloss: MPI gloss level 6; use this sheen at all locations.
      g. High Gloss: MPI gloss level 7; use this sheen at all locations.
   3. Primer: As recommended by top coat manufacturer for specific substrate.

B. Paint E-OP-FL - Concrete Floors and Wood Decks to be Painted.
   1. Two top coats and one coat primer.
   2. Top Coat Sheen:
      a. Flat: MPI gloss level 1; use this sheen for overhead surfaces.
      b. Velvet: MPI gloss level 2; use this sheen at all locations.
      c. Eggshell: MPI gloss level 3; use this sheen at all locations.
      d. Gloss: MPI gloss level 6; use this sheen at all locations.
      e. High Gloss: MPI gloss level 7; use this sheen at all locations.
   3. Primer: As recommended by top coat manufacturer for specific substrate.

C. Paint E-TR-C - Transparent Finish on Concrete Floors:
   1. 1 coat stain.
   2. Stain: Semi-Transparent Stain for Concrete Floors; MPI #58.
      a. Products:
         1) Behr Premium Semi-Transparent Concrete Stain [No. 850]. (MPI #58)
         2) PPG Paints Porter Color Seal Acrylic Waterproofing Sealer, PP3249 Series. (MPI #58)
         3) [_____].
         4) [_____].
         5) Substitutions: Section 01 6000 - Product Requirements.
   3. Sealer: Water Based Sealer for Concrete Floors; MPI #99.
      a. Products:
         1) Behr Premium Wet-Look Sealer High Gloss [No.985]. (MPI #99)

2) PPG Paints Perma-Crete Plex-Seal WB Interior/Exterior Clear Sealer Stain, 4-6200. (MPI #99)

3) Substitutions: Section 01 6000 - Product Requirements.

2.04 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.

1. Alkali Resistant Water Based Primer; MPI #3.
   a. Products:
      1) Behr Concrete and Masonry Bonding Primer [No. 880].
      2) PPG Paints Seal Grip Acrylic Primer, 17-921 Series. (MPI #3)
      3) Substitutions: Section 01 6000 - Product Requirements.
2. Interior/Exterior Latex Block Filler; MPI #4.
   a. Products:
      1) Kilz Pro-X p50 Block Filler Primer.
      2) PPG Paints Speedhide Masonry Hi Fill Latex Block Filler, 6-15. (MPI #4)
      3) Substitutions: Section 01 6000 - Product Requirements.
3. Anti-Corrosive Alkyd Primer for Metal; MPI #79.
   a. Products:
      1) PPG Paints Speedhide Interior/Exterior Rust Inhibitive Steel Primer, 6-212 Series. (MPI #79)
      2) Rodda Barrier III HS Metal Primer, 708295. (MPI #79)
      3) Substitutions: Section 01 6000 - Product Requirements.
4. Interior/Exterior Quick Dry Alkyd Primer for Metal; MPI #76.
   a. Products:
      1) PPG Devguard Multi-Purpose Primer, 4160 Series. (MPI #76)
      2) Sumter Coatings, Inc. Universal Inhibitive Primer.
      3) Substitutions: Section 01 6000 - Product Requirements.
5. Water Based Primer for Galvanized Metal; MPI #134.
6. Rust-Inhibitive Water Based Primer; MPI #107.
7. Interior/Exterior Quick Dry Primer for Aluminum; MPI #95.
8. Stain Blocking Primer; MPI #136.
9. Latex Primer for Exterior Wood; MPI #6.
10. Alkyd/Oil Primer for Exterior Wood; MPI #5.

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Test shop-applied primer for compatibility with subsequent cover materials.

F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

1. Exterior Plaster and Stucco: 12 percent.
2. Fiber Cement Siding: 12 percent.
3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.
5. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Concrete:

1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
2. Clean surfaces with pressurized water. Use pressure range of 1,500 to 4,000 psi (10,350 to 27,580 kPa) at 6 to 12 inches (150 to 300 mm). Allow to dry.
3. Clean concrete according to ASTM D4258. Allow to dry.
4. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.

G. Masonry:

1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
2. Prepare surface as recommended by top coat manufacturer.

3. Clean surfaces with pressurized water. Use pressure range of 600 to 1,500 psi (4,140 to 10,350 kPa) at 6 to 12 inches (150 to 300 mm). Allow to dry.

H. Fiber Cement Siding: Remove dirt, dust and other foreign matter with a stiff fiber brush. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

I. Exterior Gypsum Board: Fill minor defects with exterior filler compound. Spot prime defects after repair.

J. Exterior Plaster: Fill hairline cracks, small holes, and imperfections with exterior patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

K. Asphalt, Creosote, or Bituminous Surfaces: Remove foreign particles to permit adhesion of finishing materials. Apply latex based sealer or primer.

L. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

M. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

N. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

O. Galvanized Surfaces:

P. Ferrous Metal:

1. Solvent clean according to SSPC-SP 1.

2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

Q. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.

R. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.

S. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with tinted primer.

T. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.

C. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

E. Apply each coat to uniform appearance.

F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

B. Owner will provide field inspection.

C. Inspect and test questionable coated areas in accordance with industry standards and requirements.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 09 9113
EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Materials for backpriming woodwork.

D. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:

1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
2. Exposed surfaces of steel lintels and ledge angles.

E. Do Not Paint or Finish the Following Items:

1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
2. Items indicated to receive other finishes.
3. Items indicated to remain unfinished.
4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
5. Non-metallic roofing and flashing.
6. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, zinc, and lead.
7. Marble, granite, slate, and other natural stones.
8. Floors, unless specifically indicated.
9. Ceramic and other types of tiles.
10. Brick, glass unit masonry, architectural concrete, cast stone, integrally colored plaster and stucco as specified to be finished surfaces.
11. Exterior insulation and finish system (EIFS).
12. Glass.
13. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 09 9123 - Interior Painting.

1.03 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2016.

B. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating 2005 (Reapproved 2017).

C. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association Current Edition.

D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

E. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).

F. SSPC-SP 6 - Commercial Blast Cleaning 2007.

G. SSPC-SP 13 - Surface Preparation of Concrete 1997 (Reaffirmed 2003).

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
2. MPI product number (e.g. MPI #47).
3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
4. Manufacturer's installation instructions.
5. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.

1. Where sheen is specified, submit samples in only that sheen.
2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens definitely not required.
3. Allow 30 days for approval process, after receipt of complete samples by Architect.
4. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, have been approved.

D. Samples: Submit two paper chip samples 1.5" x 2" in size illustrating range of colors and textures available for each surface finishing product scheduled.

E. Samples: Submit two painted samples, illustrating selected colors and textures for each color and system selected with specified coats cascaded. Submit on aluminum sheet.

F. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

G. Manufacturer's Instructions: Indicate special surface preparation procedures.

H. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces and color samples of each color and finish used.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Paint and Finish Materials: 1 gallon (4 L) of each color; from the same product run, store where directed.
3. Label each container with color in addition to the manufacturer's label.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience and approved by manufacturer.

1.07 MOCK-UP

A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.

B. Provide panel illustrating paint color, texture, and finish.

C. Provide door and frame assembly illustrating paint color, texture, and finish.

D. Locate where directed by Architect.

E. Mock-up may remain as part of the work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.09 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer to the greatest extent possible.

1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.

2. Substitution of MPI-approved products by a different manufacturer is preferred over substitution of unapproved products by the same manufacturer.

3. Substitution of a different paint system using MPI-approved products by the same manufacturer will be considered.

B. Paints:

1. Base Manufacturer:

2. Behr Process Corporation: www.behr.com/#sle.

3. Cloverdale Paint, Brand Products of Rodda Paint Company: www.cloverdalepaint.com/#sle.
4. PPG Paints: www.ppgpaints.com/#sle.
5. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

C. Primer Sealers: Same manufacturer as top coats.

D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.

1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.
2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
3. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
4. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
5. Supply each paint material in quantity required to complete entire project's work from a single production run.
6. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content: Comply with Section 01 6116.

C. Flammability: Comply with applicable code for surface burning characteristics.

D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

E. Colors: To be selected from manufacturer's full range of available colors.

1. Selection to be made by Architect after award of contract.
2. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to Owner.
3. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.03 PAINT SYSTEMS - EXTERIOR

A. Paint E-OP - Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including concrete, concrete masonry units, brick, fiber cement siding, primed wood and primed metal.

1. Two top coats and one coat primer.
2. Top Coat Sheen:
   a. Flat: MPI gloss level 1; use this sheen for overhead surfaces.
   b. Velvet: MPI gloss level 2; use this sheen at all locations.
   c. Eggshell: MPI gloss level 3; use this sheen at all locations.

d. Satin: MPI gloss level 4; use this sheen at all locations.

e. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.

f. Gloss: MPI gloss level 6; use this sheen at all locations.

g. High Gloss: MPI gloss level 7; use this sheen at all locations.

3. Primer: As recommended by top coat manufacturer for specific substrate.

B. Paint E-OP-FL - Concrete Floors and Wood Decks to be Painted.

1. Two top coats and one coat primer.

2. Top Coat Sheen:

a. Flat: MPI gloss level 1; use this sheen for overhead surfaces.

b. Velvet: MPI gloss level 2; use this sheen at all locations.

c. Eggshell: MPI gloss level 3; use this sheen at all locations.

d. Gloss: MPI gloss level 6; use this sheen at all locations.

e. High Gloss: MPI gloss level 7; use this sheen at all locations.

3. Primer: As recommended by top coat manufacturer for specific substrate.

C. Paint E-TR-C - Transparent Finish on Concrete Floors:

1. 1 coat stain.

2. Stain: Semi-Transparent Stain for Concrete Floors; MPI #58.

a. Products:

1) Behr Premium Semi-Transparent Concrete Stain [No. 850]. (MPI #58)

2) PPG Paints Porter Color Seal Acrylic Waterproofing Sealer, PP3249 Series. (MPI #58)

3) Substitutions: Section 01 6000 - Product Requirements.

3. Sealer: Water Based Sealer for Concrete Floors; MPI #99.

a. Products:

1) Behr Premium Wet-Look Sealer High Gloss [No.985]. (MPI #99)

2) PPG Paints Perma-Crete Plex-Seal WB Interior/Exterior Clear Sealer Stain, 4-6200. (MPI #99)

3) Substitutions: Section 01 6000 - Product Requirements.

2.04 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.

1. Alkali Resistant Water Based Primer; MPI #3.

a. Products:

1) Behr Concrete and Masonry Bonding Primer [No. 880].

2) PPG Paints Seal Grip Acrylic Primer, 17-921 Series. (MPI #3)

3) Substitutions: Section 01 6000 - Product Requirements.

2. Interior/Exterior Latex Block Filler; MPI #4.

a. Products:

1) Kilz Pro-X p50 Block Filler Primer.
2) PPG Paints Speedhide Masonry Hi Fill Latex Block Filler, 6-15. (MPI #4)
3) Substitutions: Section 01 6000 - Product Requirements.

3. Anti-Corrosive Alkyd Primer for Metal; MPI #79.
   a. Products:
      1) PPG Paints Speedhide Interior/Exterior Rust Inhibitive Steel Primer, 6-212 Series. (MPI #79)
      2) Rodda Barrier III HS Metal Primer, 708295. (MPI #79)
      3) Substitutions: Section 01 6000 - Product Requirements.
4. Interior/Exterior Quick Dry Alkyd Primer for Metal; MPI #76.
   a. Products:
      1) PPG Devguard Multi-Purpose Primer, 4160 Series. (MPI #76)
      2) Sumter Coatings, Inc. Universal Inhibitive Primer.
      3) Substitutions: Section 01 6000 - Product Requirements.
5. Water Based Primer for Galvanized Metal; MPI #134.
6. Rust-Inhibitive Water Based Primer; MPI #107.
7. Interior/Exterior Quick Dry Primer for Aluminum; MPI #95.
8. Stain Blocking Primer; MPI #136.
9. Latex Primer for Exterior Wood; MPI #6.
10. Alkyd/Oil Primer for Exterior Wood; MPI #5.

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Test shop-applied primer for compatibility with subsequent cover materials.

F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

1. Exterior Plaster and Stucco: 12 percent.

2. Fiber Cement Siding: 12 percent.
3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.
5. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Concrete:

1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
2. Clean surfaces with pressurized water. Use pressure range of 1,500 to 4,000 psi (10,350 to 27,580 kPa) at 6 to 12 inches (150 to 300 mm). Allow to dry.
3. Clean concrete according to ASTM D4258. Allow to dry.
4. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.

G. Masonry:

1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
2. Prepare surface as recommended by top coat manufacturer.
3. Clean surfaces with pressurized water. Use pressure range of 600 to 1,500 psi (4,140 to 10,350 kPa) at 6 to 12 inches (150 to 300 mm). Allow to dry.

H. Fiber Cement Siding: Remove dirt, dust and other foreign matter with a stiff fiber brush. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

I. Exterior Gypsum Board: Fill minor defects with exterior filler compound. Spot prime defects after repair.

J. Exterior Plaster: Fill hairline cracks, small holes, and imperfections with exterior patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

K. Asphalt, Creosote, or Bituminous Surfaces: Remove foreign particles to permit adhesion of finishing materials. Apply latex based sealer or primer.

L. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

M. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

N. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

O. Galvanized Surfaces:

P. Ferrous Metal:

1. Solvent clean according to SSPC-SP 1.
2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

Q. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.

R. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.

S. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with tinted primer.

T. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.

C. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

E. Apply each coat to uniform appearance.

F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

B. Owner will provide field inspection.

C. Inspect and test questionable coated areas in accordance with industry standards and requirements.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 09 9123
INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Materials for backpriming woodwork.

C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.

1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
2. Elevator pit ladders.
3. Surfaces inside cabinets.
4. Prime surfaces to receive wall coverings.
5. Mechanical and Electrical:
    a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment and electrical equipment, unless otherwise indicated.
    b. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
    c. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.

D. Do Not Paint or Finish the Following Items:

1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
2. Items indicated to receive other finishes.
3. Items indicated to remain unfinished.
4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
5. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, and lead items.
6. Marble, granite, slate, and other natural stones.
7. Floors, unless specifically indicated.
8. Ceramic and other tiles.
9. Brick, architectural concrete, cast stone, integrally colored plaster and stucco.
10. Glass.
11. Concrete masonry units in utility, mechanical, and electrical spaces.
12. Acoustical materials, unless specifically indicated.
13. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 09 9113 - Exterior Painting.

C. Section 09 9600 - High-Performance Coatings.

D. Section 09 9725 - Mineral-Based Coatings.

E. Section 32 1723.13 - Painted Pavement Markings: Painted pavement markings.

F. Section 33 1600 - Water Utility Storage Tanks: Painting inside and outside of tanks.

1.03 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2016.

C. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating 2005 (Reapproved 2017).

D. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2016.

E. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association Current Edition.

F. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

G. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).

H. SSPC-SP 13 - Surface Preparation of Concrete 1997 (Reaffirmed 2003).

1.05 SUBMITTALS

A. Product Data: Provide complete list of products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
2. MPI product number (e.g. MPI #47).
3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches (200 mm) square.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Paint and Finish Materials: 1 gallon (4 L) of each color; from the same product run, store where directed.
3. Label each container with color in addition to the manufacturer's label.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

D. Maintain containers in clean condition, free of foreign materials and residue.

E. Remove rags and waste from storage areas daily.

1.08 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Minimum Application Temperatures for Paints: 50 degrees F (10 degrees C) for interiors unless required otherwise by manufacturer's instructions.

D. Maximum Application Temperatures for Paints: 95 degrees F (35 degrees C) for interiors unless required otherwise by manufacturer's instructions. `

E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

F. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

C. Paints:

1. Base Manufacturer: .
2. Behr Process Corporation: www.behr.com/#sle.
3. Cloverdale Paint, Brand Products of Rodda Paint Company: www.cloverdalepaint.com/#sle.
4. PPG Paints: www.ppgpaints.com/#sle.
5. Rodda Paint Co: www.roddapaint.com/#sle.
6. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

D. Primer Sealers: Same manufacturer as top coats.

E. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.

1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.
2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
3. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
4. Supply each paint material in quantity required to complete entire project's work from a single production run.
5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
6. Material Compatibility:
    a. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
    b. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. Volatile Organic Compound (VOC) Content: Comply with Section 01 6116.

C. Volatile Organic Compound (VOC) Content:

1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
    a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
    b. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; www.otcair.org; specifically:
        1) Opaque, Flat: 50 g/L, maximum.
        2) Opaque, Nonflat: 150 g/L, maximum.
        3) Primers, Sealers, and Undercoaters: 200 g/L.
        4) Opaque, High Gloss: 250 g/L, maximum.
    c. Architectural coatings VOC limits of Maryland.
    d. USGBC LEED Rating System; for interior wall and ceiling finish (all coats), anti-corrosive paints on interior ferrous metal, sanding sealers, other sealers, and floor coatings.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

D. Flammability: Comply with applicable code for surface burning characteristics.

E. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

2.03 PAINT SYSTEMS - INTERIOR

A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete, concrete masonry units, brick, wood, plaster, uncoated steel, shop primed steel, galvanized steel and aluminum.

1. Two top coats and one coat primer.
2. Top Coat(s): Interior Latex; MPI #43, 44, 52, 53, 54, or 114.
    a. Products: Basis of Design
        1) Sherwin-Williams Harmony Interior Acrylic Latex, Flat. (MPI #53)
        2) Sherwin-Williams Harmony Interior Acrylic Latex, Semi-Gloss. (MPI #54)
        3) Sherwin-Williams Harmony Interior Acrylic Latex, Eg-Shel. (MPI #44)
        4) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Flat.
        5) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Semi-Gloss. (MPI #43)
        6) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Low Sheen. (MPI #44)
        7) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Eg-Shel. (MPI #52)
        8) Substitutions: Section 01 6000 - Product Requirements.
3. Top Coat Sheen:
    a. Flat: MPI gloss level 1; use this sheen for ceilings and other overhead surfaces.
    b. Velvet: MPI gloss level 2; use this sheen at all locations.
    c. Eggshell: MPI gloss level 3; use this sheen at all locations.
    d. Satin: MPI gloss level 4; use this sheen for items subject to frequent touching by occupants, including door frames and railings.
    e. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
    f. Gloss: MPI gloss level 6; use this sheen at all locations.
4. Primer: As recommended by top coat manufacturer for specific substrate.

B. Paint I-OP-FL - Concrete and Wood Floors to be Painted.

1. Two top coats and one coat primer.

2.04 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.

1. Alkali Resistant Water Based Primer; [_____].
    a. Products: Basisof Design
        1) Behr Concrete and Masonry Bonding Primer [No. 880].
        2) Behr Premium Plus Interior/Exterior Multi-Surface Primer and Sealer [No. 436]. (MPI #3)
        3) PPG Paints Perma-Crete Interior/Exterior Alkali Resistant Primer, 4-603 Series. (MPI #3)
        4) PPG Paints Seal Grip Acrylic Primer, 17-921 Series. (MPI #3)

5) Rodda First Coat Interior Exterior Latex Primer, 501601. (MPI #3)

6) Rodda pHlex-Tite Elastomeric Coating, 512301. (MPI #3)

7) Substitutions: Section 01 6000 - Product Requirements.

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 INSTALLERS

A. Acceptable Applicators:

3.02 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

D. Test shop-applied primer for compatibility with subsequent cover materials.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

1. Gypsum Wallboard: 12 percent.
2. Plaster and Stucco: 12 percent.
3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
5. Concrete Floors and Traffic Surfaces: 8 percent.

3.03 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.

C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

D. Remove or repair existing paints or finishes that exhibit surface defects.

E. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

F. Seal surfaces that might cause bleed through or staining of topcoat.

G. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

H. Concrete:

1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
2. Clean surfaces with pressurized water. Use pressure range of 1,500 to 4,000 psi (10,350 to 27,580 kPa) at 6 to 12 inches (150 to 300 mm). Allow to dry.
3. Clean concrete according to ASTM D4258. Allow to dry.
4. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.

I. Masonry:

1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
2. Prepare surface as recommended by top coat manufacturer.
3. Clean surfaces with pressurized water. Use pressure range of 600 to 1,500 psi (4,140 to 10,350 kPa) at 6 to 12 inches (150 to 300 mm). Allow to dry.

J. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

K. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

L. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

M. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

N. Galvanized Surfaces:

O. Ferrous Metal:

1. Solvent clean according to SSPC-SP 1.
2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

P. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

3.04 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.

3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

E. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

F. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

G. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

H. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms:
    a. Items as directed by Architect.
2. Paint the following work where exposed in occupied spaces:
    a. Items as directed by Architect.
3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

I. Sand wood and metal surfaces lightly between coats to achieve required finish.

J. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

K. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

L. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.05 FIELD QUALITY CONTROL

A. Owner will provide field inspection.

B. Dry Film Thickness Testing: Engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

C. Contractor shall touch up and restore painted surfaces damaged by testing.

D. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.06 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.07 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

3.08 COLOR SCHEDULE

A. Classroom 201: EXAMPLE: AS SCHEDULED ON THE "FINISH SCHEDULE"

1. North, west, and east walls - #3184 blue.
2. South accent wall - #4467 yellow.
3. Paint access panels same as walls.
4. Paint convector cover - #2237 pink.

B. Principal's Office:

1. Walls - #1234 green.
2. Trim - #5512 gray.

END OF SECTION

SECTION 09 9123
INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Materials for backpriming woodwork.

C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.

1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
2. Elevator pit ladders.
3. Surfaces inside cabinets.
4. Prime surfaces to receive wall coverings.
5. Mechanical and Electrical:
    a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment and electrical equipment, unless otherwise indicated.
    b. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
    c. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.

D. Do Not Paint or Finish the Following Items:

1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
2. Items indicated to receive other finishes.
3. Items indicated to remain unfinished.
4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
5. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, and lead items.
6. Marble, granite, slate, and other natural stones.
7. Floors, unless specifically indicated.
8. Ceramic and other tiles.
9. Brick, architectural concrete, cast stone, integrally colored plaster and stucco.
10. Glass.
11. Concrete masonry units in utility, mechanical, and electrical spaces.
12. Acoustical materials, unless specifically indicated.
13. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 09 9113 - Exterior Painting.

C. Section 09 9600 - High-Performance Coatings.

D. Section 09 9725 - Mineral-Based Coatings.

E. Section 32 1723.13 - Painted Pavement Markings: Painted pavement markings.

F. Section 33 1600 - Water Utility Storage Tanks: Painting inside and outside of tanks.

1.03 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2016.

C. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating 2005 (Reapproved 2017).

D. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2016.

E. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association Current Edition.

F. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

G. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).

H. SSPC-SP 2 - Hand Tool Cleaning 1982, with Editorial Revision (2004).

I. SSPC-SP 13 - Surface Preparation of Concrete 1997 (Reaffirmed 2003).

1.05 SUBMITTALS

A. Product Data: Provide complete list of products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").

2. MPI product number (e.g. MPI #47).

3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches (200 mm) square.

2. Step coats on Samples to show each coat required for system.

3. Label each coat of each Sample.

4. Label each Sample for location and application area.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.

1. Where sheen is specified, submit samples in only that sheen.

2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens definitely not required.

3. Allow 30 days for approval process, after receipt of complete samples by Architect.

4. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, have been approved.

D. Samples: Submit two paper chip samples illustrating range of colors and textures available for each surface finishing product scheduled.

E. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

F. Manufacturer's Instructions: Indicate special surface preparation procedures.

G. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces and color samples of each color and finish used.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

2. Extra Paint and Finish Materials: 1 gallon (4 L) of each color; from the same product run, store where directed.

3. Label each container with color in addition to the manufacturer's label.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience and approved by manufacturer.

1.07 MOCK-UP

A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.

B. Provide panel illustrating paint color, texture, and finish.

C. Provide door and frame assembly illustrating paint color, texture, and finish.

D. Locate where directed by Architect.

E. Mock-up may remain as part of the work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

D. Maintain containers in clean condition, free of foreign materials and residue.

E. Remove rags and waste from storage areas daily.

1.09 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F (3 degrees C) above the dew point; or to damp or wet surfaces.

D. Minimum Application Temperatures for Paints: 50 degrees F (10 degrees C) for interiors unless required otherwise by manufacturer's instructions.

E. Maximum Application Temperatures for Paints: 95 degrees F (35 degrees C) for interiors unless required otherwise by manufacturer's instructions. `

F. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

G. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

C. Paints:

1. Base Manufacturer: .
2. Behr Process Corporation: www.behr.com/#sle.
3. Cloverdale Paint, Brand Products of Rodda Paint Company: www.cloverdalepaint.com/#sle.
4. PPG Paints: www.ppgpaints.com/#sle.
5. Rodda Paint Co: www.roddapaint.com/#sle.
6. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

D. Primer Sealers: Same manufacturer as top coats.

E. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.

1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.
2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
3. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
4. Supply each paint material in quantity required to complete entire project's work from a single production run.
5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
6. Material Compatibility:

a. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

b. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. Volatile Organic Compound (VOC) Content: Comply with Section 01 6116.

C. Volatile Organic Compound (VOC) Content:

1. Provide paints and finishes that comply with the most stringent requirements specified in the following:

a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.

b. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; www.otcair.org; specifically:

1) Opaque, Flat: 50 g/L, maximum.

2) Opaque, Nonflat: 150 g/L, maximum.

3) Primers, Sealers, and Undercoaters: 200 g/L.

4) Opaque, High Gloss: 250 g/L, maximum.

c. Architectural coatings VOC limits of Maryland.

d. USGBC LEED Rating System; for interior wall and ceiling finish (all coats), anti-corrosive paints on interior ferrous metal, sanding sealers, other sealers, and floor coatings.

2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

D. Flammability: Comply with applicable code for surface burning characteristics.

E. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

2.03 PAINT SYSTEMS - INTERIOR

A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete, concrete masonry units, brick, wood, plaster, uncoated steel, shop primed steel, galvanized steel and aluminum.

1. Two top coats and one coat primer.

2. Top Coat(s): Interior Latex; MPI #43, 44, 52, 53, 54, or 114.

a. Products: Basis of Design

1) Sherwin-Williams Harmony Interior Acrylic Latex, Flat. (MPI #53)

2) Sherwin-Williams Harmony Interior Acrylic Latex, Semi-Gloss. (MPI #54)

3) Sherwin-Williams Harmony Interior Acrylic Latex, Eg-Shel. (MPI #44)

4) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Flat.

5) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Semi-Gloss. (MPI #43)

6) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Low Sheen. (MPI #44)

7) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Eg-Shel. (MPI #52)

8) Substitutions: Section 01 6000 - Product Requirements.

3. Top Coat Sheen:

a. Flat: MPI gloss level 1; use this sheen for ceilings and other overhead surfaces.

b. Velvet: MPI gloss level 2; use this sheen at all locations.

c. Eggshell: MPI gloss level 3; use this sheen at all locations.

d. Satin: MPI gloss level 4; use this sheen for items subject to frequent touching by occupants, including door frames and railings.

e. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.

f. Gloss: MPI gloss level 6; use this sheen at all locations.

4. Primer: As recommended by top coat manufacturer for specific substrate.

B. Paint I-OP-FL - Concrete and Wood Floors to be Painted.

1. Two top coats and one coat primer.

2.04 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.

1. Alkali Resistant Water Based Primer; [_____].

a. Products: Basisof Design

1) Behr Concrete and Masonry Bonding Primer [No. 880].

2) Behr Premium Plus Interior/Exterior Multi-Surface Primer and Sealer [No. 436]. (MPI #3)

3) PPG Paints Perma-Crete Interior/Exterior Alkali Resistant Primer, 4-603 Series. (MPI #3)

4) PPG Paints Seal Grip Acrylic Primer, 17-921 Series. (MPI #3)

5) Rodda First Coat Interior Exterior Latex Primer, 501601. (MPI #3)

6) Rodda pHlex-Tite Elastomeric Coating, 512301. (MPI #3)

7) Substitutions: Section 01 6000 - Product Requirements.

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 INSTALLERS

A. Acceptable Applicators:

3.02 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

D. Test shop-applied primer for compatibility with subsequent cover materials.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

1. Gypsum Wallboard: 12 percent.
2. Plaster and Stucco: 12 percent.
3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
5. Concrete Floors and Traffic Surfaces: 8 percent.

3.03 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.

C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

D. Remove or repair existing paints or finishes that exhibit surface defects.

E. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

F. Seal surfaces that might cause bleed through or staining of topcoat.

G. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

H. Concrete:

1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
2. Clean surfaces with pressurized water. Use pressure range of 1,500 to 4,000 psi (10,350 to 27,580 kPa) at 6 to 12 inches (150 to 300 mm). Allow to dry.
3. Clean concrete according to ASTM D4258. Allow to dry.
4. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.

I. Masonry:

1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
2. Prepare surface as recommended by top coat manufacturer.
3. Clean surfaces with pressurized water. Use pressure range of 600 to 1,500 psi (4,140 to 10,350 kPa) at 6 to 12 inches (150 to 300 mm). Allow to dry.

J. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

K. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

L. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

M. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

N. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

O. Copper: Remove contamination by steam, high pressure water, or solvent washing.

P. Galvanized Surfaces:

1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
2. Prepare surface according to SSPC-SP 2.

Q. Ferrous Metal:

1. Solvent clean according to SSPC-SP 1.
2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

R. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

S. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.

T. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

U. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.04 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

F. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

G. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

H. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

I. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms:

a. Items as directed by Architect.

2. Paint the following work where exposed in occupied spaces:

a. Items as directed by Architect.

3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

J. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

K. Sand wood and metal surfaces lightly between coats to achieve required finish.

L. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

M. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

N. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.05 FIELD QUALITY CONTROL

A. Owner will provide field inspection.

B. Dry Film Thickness Testing: Engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

C. Contractor shall touch up and restore painted surfaces damaged by testing.

D. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.06 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.07 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

3.08 COLOR SCHEDULE

A. Classroom 201: EXAMPLE: AS SCHEDULED ON THE "FINISH SCHEDULE"

1. North, west, and east walls - #3184 blue.
2. South accent wall - #4467 yellow.
3. Paint access panels same as walls.
4. Paint convector cover - #2237 pink.

B. Principal's Office:

1. Walls - #1234 green.
2. Trim - #5512 gray.

END OF SECTION

SECTION 09 9300
STAINING AND TRANSPARENT FINISHING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of stains and transparent finishes.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 09 9113 - Exterior Painting: Stains and transparent finishes for concrete substrates.

C. Section 09 9123 - Interior Painting: Stains and transparent finishes for concrete substrates.

1.03 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2016.

C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2016.

D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category.

C. Samples: Submit two samples, illustrating selected colors and sheens for each system with specified coats cascaded. Submit on actual wood substrate to be finished, [8" x 8"] inch ([203 x 203] mm) in size.

D. Certification: By manufacturer that stains and transparent finishes comply with VOC limits specified.

E. Applicator's Qualification Statement.

F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, safety data sheets (SDS), care and cleaning instructions, touch-up procedures and color samples of each color and finish used.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of stain or transparent finish, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color

designation, and instructions for mixing and reducing.

C. Stain and Transparent Finish Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by manufacturer of stains and transparent finishes.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F (3 degrees C) above the dew point; or to damp or wet surfaces.

D. Minimum Application Temperature: 50 degrees F (10 degrees C) unless required otherwise by manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide finishes from the same manufacturer to the greatest extent possible.

1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
2. Substitution of other products by the same manufacturer is preferred over substitution of products by a different manufacturer.
3. Substitution of a different system using MPI-approved products by the same manufacturer will be considered.

B. Transparent Finishes:

1. Base Manufacturer: .
2. PPG Paints Deft Interior Clears/Polyurethanes: www.ppgpaints.com/#sle.
3. PPG Paints ProLuxe Transparent Finishes: www.perfectwoodstains.com/#sle.

C. Stains:

1. Base Manufacturer:
2. PPG Paints Deft Interior Stains: www.ppgpaints.com/#sle.
3. PPG Paints ProLuxe Stains: www.perfectwoodstains.com/#sle.

D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 STAINS AND TRANSPARENT FINISHES - GENERAL

A. Finishes:

1. Provide finishes capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

3. Supply each finish material in quantity required to complete entire project's work from a single production run.
4. Do not reduce, thin, or dilute finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:
1. Provide stains and transparent finishes that comply with the most stringent requirements specified in the following:
a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
b. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; www.otcair.org; specifically:
1) Opaque, Flat: 50 g/L, maximum.
2) Opaque, Nonflat: 150 g/L, maximum.
3) Opaque, High Gloss: 250 g/L, maximum.
4) Varnishes: 350 g/L, maximum.
c. Architectural coatings VOC limits of Maryland.
d. USGBC LEED Rating System; for interior wall and ceiling finish (all coats), clear wood stains and finishes, sanding sealers, other sealers, shellac, and floor coatings.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Flammability: Comply with applicable code for surface burning characteristics.

D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

E. Colors: To be selected from manufacturer's full range of available colors.
1. Selection to be made by Architect after award of contract.
2. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.03 EXTERIOR STAIN AND TRANSPARENT FINISH SYSTEMS

A. Finish on Wood:
1. Stain: Exterior Solid Stain for Wood, Water Based; MPI #16.
2. Stain: Exterior Semi-Transparent Stain for Wood, Water Based; MPI #156.
3. Stain: Exterior Semi-Transparent Stain for Wood, Solvent Based; MPI #13.
4. Stain: Exterior Semi-Transparent Stain for Wood Decks, Solvent Based or Water Based; MPI #33.
5. Top Coat(s): Exterior Clear Water Based Varnish with UV Inhibitor.
6. Top Coat(s): Exterior Clear Alkyd Varnish with UV Inhibitor.
7. Top Coat Sheen:
a. Flat: MPI gloss level 1; use this sheen at all locations.
b. Eggshell: MPI gloss level 3; use this sheen at all locations.
c. Satin: MPI gloss level 4; use this sheen at all locations.

d. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.

e. Gloss: MPI gloss level 6; use this sheen at all locations.

f. High Gloss: MPI gloss level 7; use this sheen at all locations.

2.04 INTERIOR STAIN AND TRANSPARENT FINISH SYSTEMS

A. Finish on Wood - Vertical Surfaces:

1. 2 coat(s) stain.
2. 2 coat(s) sealer.
3. 2 coat(s) varnish.
4. 2 coat(s) varnish over 1 coat(s) stain.
5. Stain: Semi-Transparent Stain for Wood, Solvent Based; MPI #90.
6. Stain: Semi-Transparent Stain for Wood, Water Based; MPI #186.
7. Sealer: Alkyd, Sanding Sealer, Clear; MPI #102.
8. Sealer: Lacquer, Sanding Sealer, White; MPI #24.
9. Top Coat(s): Polyurethane Varnish, Oil Modified; MPI #56 or 57.
10. Top Coat(s): Alkyd Varnish; MPI #73 or 75.
11. Top Coat(s): Clear Water Based Varnish; MPI #128, 129, or 130.
12. Top Coat(s): Clear Lacquer; MPI #85, 86, or 87.
13. Top Coat Sheen:
    a. Flat: MPI gloss level 1; use this sheen at all locations.
    b. Eggshell: MPI gloss level 3; use this sheen at all locations.
    c. Satin: MPI gloss level 4; use this sheen at all locations.
    d. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
    e. Gloss: MPI gloss level 6; use this sheen at all locations.
    f. High Gloss: MPI gloss level 7; use this sheen at all locations.

B. Finish on Wood - Floors.

1. Stain: Semi-Transparent Stain for Wood; MPI #90.
2. Top Coat(s): Polyurethane Varnish, Oil Modified; MPI #56 or 57.
3. Top Coat Sheen:
    a. Eggshell: MPI gloss level 3; use this sheen at all locations.
    b. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
    c. Gloss: MPI gloss level 6; use this sheen at all locations.

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of finished surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 INSTALLERS

A. Acceptable Applicators:

3.02 EXAMINATION

A. Do not begin application of stains and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

1. Wood: 15 percent, measured in accordance with ASTM D4442.

3.03 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or repair existing finishes that exhibit surface defects.

D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

G. Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

H. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

3.04 APPLICATION

A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

D. Sand wood surfaces lightly between coats to achieve required finish.

E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

F. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

G. Reinstall items removed prior to finishing.

3.05 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

B. Owner will provide field inspection.

C. Inspect and test questionable coated areas in accordance with industry standards & requirements.

3.06 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.07 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 09 9300
STAINING AND TRANSPARENT FINISHING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of stains and transparent finishes.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 09 9113 - Exterior Painting: Stains and transparent finishes for concrete substrates.

C. Section 09 9123 - Interior Painting: Stains and transparent finishes for concrete substrates.

1.03 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2016.

C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2016.

D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category.

2. Manufacturer's installation instructions.

3. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.

C. Samples: Submit two samples, illustrating selected colors and sheens for each system with specified coats cascaded. Submit on actual wood substrate to be finished, [8" x 8"] inch ([203 x 203] mm) in size.

D. Certification: By manufacturer that stains and transparent finishes comply with VOC limits specified.

E. Manufacturer's Instructions: Indicate special surface preparation procedures.

F. Manufacturer's Qualification Statement.

G. Applicator's Qualification Statement.

H. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, safety data sheets (SDS), care and cleaning instructions, touch-up procedures and color samples of each color and finish used.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

2. Extra Stain and Transparent Finish Materials: 1 gallon (4 L) of each color and type; from the same product run, store where directed.
3. Label each container with color and type in addition to the manufacturer's label.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of stain or transparent finish, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Stain and Transparent Finish Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by manufacturer of stains and transparent finishes.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F (3 degrees C) above the dew point; or to damp or wet surfaces.

D. Minimum Application Temperature: 50 degrees F (10 degrees C) unless required otherwise by manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide finishes from the same manufacturer to the greatest extent possible.

1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
2. Substitution of other products by the same manufacturer is preferred over substitution of products by a different manufacturer.
3. Substitution of a different system using MPI-approved products by the same manufacturer will be considered.

B. Transparent Finishes:

1. Base Manufacturer: .
2. PPG Paints Deft Interior Clears/Polyurethanes: www.ppgpaints.com/#sle.
3. PPG Paints ProLuxe Transparent Finishes: www.perfectwoodstains.com/#sle.

C. Stains:

1. Base Manufacturer:
2. PPG Paints Deft Interior Stains: www.ppgpaints.com/#sle.
3. PPG Paints ProLuxe Stains: www.perfectwoodstains.com/#sle.

D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 STAINS AND TRANSPARENT FINISHES - GENERAL

A. Finishes:

1. Provide finishes capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
3. Supply each finish material in quantity required to complete entire project's work from a single production run.
4. Do not reduce, thin, or dilute finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:

1. Provide stains and transparent finishes that comply with the most stringent requirements specified in the following:
   a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
   b. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; www.otcair.org; specifically:
      1) Opaque, Flat: 50 g/L, maximum.
      2) Opaque, Nonflat: 150 g/L, maximum.
      3) Opaque, High Gloss: 250 g/L, maximum.
      4) Varnishes: 350 g/L, maximum.
   c. Architectural coatings VOC limits of Maryland.
   d. USGBC LEED Rating System; for interior wall and ceiling finish (all coats), clear wood stains and finishes, sanding sealers, other sealers, shellac, and floor coatings.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Flammability: Comply with applicable code for surface burning characteristics.

D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

E. Colors: To be selected from manufacturer's full range of available colors.

1. Selection to be made by Architect after award of contract.
2. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.03 EXTERIOR STAIN AND TRANSPARENT FINISH SYSTEMS

A. Finish on Wood:
   1. 2 coat(s) stain.
   2. 2 coat(s) varnish.
   3. Stain: Exterior Solid Stain for Wood, Water Based; MPI #16.
   4. Stain: Exterior Semi-Transparent Stain for Wood, Water Based; MPI #156.
   5. Stain: Exterior Semi-Transparent Stain for Wood, Solvent Based; MPI #13.
   6. Stain: Exterior Semi-Transparent Stain for Wood Decks, Solvent Based or Water Based; MPI #33.
   7. Top Coat(s): Exterior Clear Water Based Varnish with UV Inhibitor.
   8. Top Coat(s): Exterior Clear Alkyd Varnish with UV Inhibitor.
   9. Top Coat Sheen:
      a. Flat: MPI gloss level 1; use this sheen at all locations.
      b. Eggshell: MPI gloss level 3; use this sheen at all locations.
      c. Satin: MPI gloss level 4; use this sheen at all locations.
      d. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
      e. Gloss: MPI gloss level 6; use this sheen at all locations.
      f. High Gloss: MPI gloss level 7; use this sheen at all locations.

2.04 INTERIOR STAIN AND TRANSPARENT FINISH SYSTEMS

A. Finish on Wood - Vertical Surfaces:
   1. 2 coat(s) stain.
   2. 2 coat(s) sealer.
   3. 2 coat(s) varnish.
   4. 2 coat(s) varnish over 1 coat(s) stain.
   5. Stain: Semi-Transparent Stain for Wood, Solvent Based; MPI #90.
   6. Stain: Semi-Transparent Stain for Wood, Water Based; MPI #186.
   7. Sealer: Alkyd, Sanding Sealer, Clear; MPI #102.
   8. Sealer: Lacquer, Sanding Sealer, White; MPI #24.
   9. Top Coat(s): Polyurethane Varnish, Oil Modified; MPI #56 or 57.
   10. Top Coat(s): Alkyd Varnish; MPI #73 or 75.
   11. Top Coat(s): Clear Water Based Varnish; MPI #128, 129, or 130.
   12. Top Coat(s): Clear Lacquer; MPI #85, 86, or 87.
   13. Top Coat Sheen:
      a. Flat: MPI gloss level 1; use this sheen at all locations.
      b. Eggshell: MPI gloss level 3; use this sheen at all locations.
      c. Satin: MPI gloss level 4; use this sheen at all locations.
      d. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
      e. Gloss: MPI gloss level 6; use this sheen at all locations.

f. High Gloss: MPI gloss level 7; use this sheen at all locations.

B. Finish on Wood - Floors.

1. Stain: Semi-Transparent Stain for Wood; MPI #90.
2. Top Coat(s): Polyurethane Varnish, Oil Modified; MPI #56 or 57.
3. Top Coat Sheen:
   a. Eggshell: MPI gloss level 3; use this sheen at all locations.
   b. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
   c. Gloss: MPI gloss level 6; use this sheen at all locations.

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of finished surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 INSTALLERS

3.02 EXAMINATION

A. Do not begin application of stains and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

1. Wood: 15 percent, measured in accordance with ASTM D4442.

3.03 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or repair existing finishes that exhibit surface defects.

D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

G. Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

H. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

3.04 APPLICATION

A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

D. Sand wood surfaces lightly between coats to achieve required finish.

E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

F. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

G. Reinstall items removed prior to finishing.

3.05 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

B. Owner will provide field inspection.

C. Inspect and test questionable coated areas in accordance with industry standards & requirements.

3.06 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.07 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 09 9600
HIGH-PERFORMANCE COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. High performance coatings.

B. Surface preparation.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 09 9113 - Exterior Painting.

C. Section 09 9123 - Interior Painting: Requirements for mechanical and electrical equipment surfaces.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.

B. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board 2007.

C. SCAQMD 1113 - Architectural Coatings 1977 (Amended 2016).

D. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).

E. SSPC-SP 3 - Power Tool Cleaning 1982, with Editorial Revision (2004).

F. SSPC-SP 5 - White Metal Blast Cleaning 2007.

G. SSPC-SP 7 - Brush-Off Blast Cleaning 2007.

H. SSPC-SP 13 - Surface Preparation of Concrete 1997 (Reaffirmed 2003).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide complete list of all products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").

2. MPI product number (e.g. MPI #47).

3. Cross-reference to specified coating system(s) product is to be used in; include description of each system.

4. Manufacturer's installation instructions.

C. Samples: Submit two samples 8 by 8 inch (203 by 203 mm) in size illustrating colors available for selection.

PART 2 PRODUCTS

2.01 TOP COAT MATERIALS

A. Coatings - General: Provide complete multi-coat systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated; number of coats specified does not include primer or filler coat.

1. Lead Content: Not greater than 0.06 percent by weight of total nonvolatile content.

2. Chromium Content, as Hexavalent Chromium, Zinc Chromate, or Strontium Chromate: None.

END OF SECTION

SECTION 09 9600
HIGH-PERFORMANCE COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. High performance coatings.

B. Surface preparation.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 09 9113 - Exterior Painting.

C. Section 09 9123 - Interior Painting: Requirements for mechanical and electrical equipment surfaces.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.

B. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating 2005 (Reapproved 2017).

C. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board 2007.

D. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association Current Edition.

E. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

F. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. SCAQMD 1113 - Architectural Coatings 1977 (Amended 2016).

H. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).

I. SSPC-SP 3 - Power Tool Cleaning 1982, with Editorial Revision (2004).

J. SSPC-SP 5 - White Metal Blast Cleaning 2007.

K. SSPC-SP 7 - Brush-Off Blast Cleaning 2007.

L. SSPC-SP 13 - Surface Preparation of Concrete 1997 (Reaffirmed 2003).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide complete list of all products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
2. MPI product number (e.g. MPI #47).
3. Cross-reference to specified coating system(s) product is to be used in; include description of each system.
4. Manufacturer's installation instructions.
5. If proposal of substitutions is allowed under submittal procedures, explanation of all substitutions proposed.

C. Samples: Submit two samples 8 by 8 inch (203 by 203 mm) in size illustrating colors available for selection.

D. Manufacturer's Certificate: Certify that high-performance coatings comply with VOC limits specified.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

G. Maintenance Data: Include cleaning procedures and repair and patching techniques.

H. Maintenance Materials: Furnish the following for Owner 's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Coating Materials: 1 gallon (4 liters) of each type and color.
3. Label each container with manufacturer's name, product number, color number, and room names and numbers where used.

1.05 QUALITY ASSURANCE

A. Maintain one copy of each referenced document that applies to application on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

C. Applicator Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience.

1.06 MOCK-UP

A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.

B. Provide mock-up illustrating coating , for each specified coating.

C. Locate where directed.

D. Mock-up may remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of coating, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Coating Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the coating product manufacturer.

C. Do not install materials when temperature is below 55 degrees F (13 degrees C) or above 90 degrees F (32 degrees C).

D. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.

E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

F. Restrict traffic from area where coating is being applied or is curing.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for bond to substrate.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Only materials (primers, coatings, etc.) listed in the latest edition of the MPI Approved Product List (APL) are acceptable for use on this project.

B. Provide high performance coating products from the same manufacturer to the greatest extent possible.

1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.

2. Substitution of MPI-approved products by a different manufacturer is preferred over substitution of unapproved products by the same manufacturer.

3. Substitution of a different high performance coating system using MPI-approved products by the same manufacturer will be considered.

C. High-Performance Coatings:

1. Dow Chemical Company: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.

2. PPG Paints: www.ppgpaints.com/#sle.

3. Sherwin-Williams Company: www.protective.sherwin-williams.com/industries/#sle.

4. Substitutions: Section 01 6000 - Product Requirements.

2.02 HIGH-PERFORMANCE COATINGS

A. Provide coating systems that meet the following minimum performance criteria, unless more stringent criteria are specified:

1. NFPA 101, Class A rated.

2.03 TOP COAT MATERIALS

A. Coatings - General: Provide complete multi-coat systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated; number of coats specified does not include primer or filler coat.

1. Lead Content: Not greater than 0.06 percent by weight of total nonvolatile content.

2. Chromium Content, as Hexavalent Chromium, Zinc Chromate, or Strontium Chromate: None.

3. Volatile Organic Compound (VOC) Content: Comply with Section 01 6116.

B. Shellac: Pure, white type.

2.04 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by coating manufacturer.

1. Primer Sealer, Interior, Institutional Low Odor; MPI #149.

2. Block Filler, Epoxy; MPI #116.
3. Block Filler, Latex; MPI #4.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Do not begin application of coatings until substrates have been properly prepared.

C. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.

D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

F. Test shop-applied primer for compatibility with subsequent cover materials.

G. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

1. Cementitious Substrates: Do not begin application until substrate has cured 28 days minimum and measured moisture content is not greater than 12 percent.
2. Plaster and Stucco: 12 percent.
3. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
4. Concrete Floors and Traffic Surfaces: 8 percent.
5. Wood: Do not begin application if substrate has moisture content over 12 percent.

H. Masonry: Verify masonry joints are struck flush.

I. Proceed with coating application only after unacceptable conditions have been corrected.

1. Commencing coating application constitutes Contractor's acceptance of substrates and conditions.

3.02 PREPARATION

A. Clean surfaces of loose foreign matter.

B. Remove substances that would bleed through finished coatings. If unremovable, seal surface with shellac.

C. Remove finish hardware, fixture covers, and accessories and store.

D. Existing Painted and Sealed Surfaces:

1. Strip existing paint and coatings from surface.
2. Clean with mixture of trisodium phosphate and water to remove surface grease and foreign matter.

E. Concrete:

1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
2. Clean surfaces with pressurized water. Use pressure range of 1,500 to 4,000 psi (10,350 to 27,580 kPa) at 6 to 12 inches (150 to 300 mm). Allow to dry.
3. Clean concrete according to ASTM D4258. Allow to dry.

4. Prepare surface as recommended by coating manufacturer and according to SSPC-SP 13.

F. Masonry:

1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.

2. Prepare surface as recommended by coating manufacturer.

3. Clean surfaces with pressurized water. Use pressure range of 600 to 1,500 psi (4,140 to 10,350 kPa) at 6 to 12 inches (150 to 300 mm). Allow to dry.

G. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.

3.03 PRIMING

A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

B. Concrete: Prior to priming, patch with masonry filler to produce smooth surface.

C. Concrete Masonry: Apply masonry filler to thickness required to fill holes and produce smooth surface; minimum thickness of 30 mils (0.8 mm).

D. Wood Items to Receive Transparent Finish: Wipe off dust and grit, sealing, seal knots, pitch streaks, and sappy sections as directed by coating manufacturer. Fill nail holes and cracks with matching tinted filler.

3.04 COATING APPLICATION

A. Apply coatings in accordance with manufacturer's written instructions, to thicknesses specified and recommendations in "MPI Architectural Painting and Specification Manual".

B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.05 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection.

B. Owner will provide field inspection.

C. Inspect and test questionable coated areas in accordance with [_____].

D. Dry Film Thickness Testing: Owner will engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.

1. Touch up and restore coated surfaces damaged by testing.

2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, and specified thickness, Contractor shall pay for retesting and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations, and specified thickness.

3.06 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Clean surfaces immediately of overspray, splatter, and excess material.

C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.07 PROTECTION

A. Protect finished work from damage.

END OF SECTION

SECTION 09 9723
CONCRETE AND MASONRY COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Moisture resistant textured concrete and masonry coatings.

B. Moisture resistant smooth concrete and masonry coatings.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 09 9113 - Exterior Painting.

1.03 REFERENCE STANDARDS

A. ASTM D522/D522M - Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings 2017.

B. ASTM D714 - Standard Test Method for Evaluating Degree of Blistering of Paints 2002 (Reapproved 2009).

C. ASTM D968 - Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive 2017.

D. ASTM D2243 - Standard Test Method for Freeze-Thaw Resistance of Water-Borne Coatings 1995 (Reapproved 2014).

E. ASTM D4803 - Standard Test Method for Predicting Heat Buildup in PVC Building Products 2018.

F. ASTM D6904 - Standard Practice for Resistance to Wind-Driven Rain for Exterior Coatings Applied on Masonry 2003 (Reapproved 2013).

G. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.

H. SSPC-SP 2 - Hand Tool Cleaning 1982, with Editorial Revision (2004).

I. SSPC-SP 3 - Power Tool Cleaning 1982, with Editorial Revision (2004).

J. SSPC-SP 6 - Commercial Blast Cleaning 2007.

K. SSPC-SP 7 - Brush-Off Blast Cleaning 2007.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating coating materials and [_____].

C. Samples: Submit two samples 8" x 8" in size illustrating colors available for selection.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Maintain one copy of each referenced document that applies to application on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

C. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.06 MOCK-UP

A. Provide mock-up of each type of coating, illustrating coating, color and surface sheen, for each specified coating.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

1.07 FIELD CONDITIONS

A. Do not install materials when temperature is below 55 degrees F (13 degrees C) or above 90 degrees F (32 degrees C).

B. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.

C. Restrict traffic from area where coating is being applied or is curing.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for bond to substrate.

PART 2 PRODUCTS

2.01 CONCRETE AND MASONRY COATINGS

A. Provide high-build, weather resistant coating systems that meet the following minimum performance criteria, unless more stringent criteria are specified:

1. Salt Spray Resistance: Passes when tested according to ASTM B117 for 2000 hours.
2. Surface Burning Characteristics: Flame spread/Smoke developed index of 0/0, maximum, when tested in accordance with ASTM E84.
3. Accelerated Outdoor Exposure: Passes when tested according to ASTM G153 for 5,000 hours.

2.02 MATERIALS

A. Coatings - General: Provide complete systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated.

1. Maximum volatile organic compound (VOC) content: As required by applicable regulations.

B. High Build, One Coat, Water Based Textured Coating for 'Green' Concrete: Water based, epoxy-acrylic resin with graded perlite aggregate.

1. Stated by manufacturer as suitable for installation on visibly damp surfaces and concrete that has hardened but is not fully cured ("green" concrete) without requiring a primer.
2. Dry Film Thickness: 15 mils (0.381 mm), minimum.
3. Flexibility Test: Passing, when tested according to ASTM D522/D522M with a 1 inch (25 mm) mandrel.
4. Abrasion Resistance: Passing, when tested according to ASTM D968 with 792 gallons (3,000 L) of falling sand.
5. Freeze Thaw Resistance: Passing, when tested according to ASTM D2243 for 50 cycles.
6. Wind Driven Rain Resistance: Passing, when tested according to ASTM D6904 at 98 miles per hour (158 km/h) for 24 hours.
7. Water Vapor Transmission: 20 perms (1149 ng/Pa s sq m), maximum, when tested in accordance with ASTM E96/E96M.

C. High Build, Water Based Textured Coating System for Masonry: Water based styrene-acrylic resin primer; acrylic terpolymer (elastomeric) top coat and graded perlite aggregate.

1. Stated by manufacturer as suitable for masonry and concrete surfaces cured 28 days, minimum; cement plaster, cement fiber board, and metal.
2. Dry Film Thickness: 15 mils (0.381 mm), minimum.
3. Flexibility Test: Passing, when tested according to ASTM D522/D522M with a 1 inch (25 mm) mandrel.
4. Freeze Thaw Resistance: Passing, when tested according to ASTM D2243 for 50 cycles.
5. Water Vapor Transmission: 4.2 perms (240 ng/Pa s sq m), maximum, when tested in accordance with ASTM E96/E96M.

D. High Build, Water Based Solar Reflective Textured Coating System: Water based, acrylic latex textured primer with graded perlite aggregate and acrylic copolymer solar reflective color top coat.

1. Stated by manufacturer as suitable for masonry and concrete surfaces cured 28 days, minimum; cement plaster, cement fiber board, and metal.
2. Dry Film Thickness: 13 to 18 mils (0.330 to 0.457 mm), minimum.
3. Blistering Resistance: Passing, when tested according to ASTM D714 for 100 hours.
4. Abrasion Resistance: Passing, when tested according to ASTM D968 using 218 gallons (825 L) of falling sand.
5. Freeze Thaw Resistance: Passes when tested according to ASTM D2243 for 50 cycles.
6. Surface Temperature Reduction Based on Solar Reflectance: ASTM D4803; reduction in surface temperature increase above ambient temperature when compared to control sample of conventional acrylic paint.
    a. Light colors: 25 to 35 percent.
    b. Medium colors: 55 to 65 percent.
    c. Dark colors: 100 percent.

E. Water Based Super-Hydrophobic Smooth Coating: Single component acrylic coating, color pigments, and acrylic polymer.

F. Water Based Weather Resistant Smooth Coating: Single component acrylic coating, color pigments, and acrylic polymer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.

C. Cementitious Substrates: Do not begin application until substrate has cured 28 days minimum and measured moisture content is not greater than 16 percent.

D. Masonry: Verify masonry joints are struck flush.

3.02 PREPARATION

A. Clean surfaces of loose foreign matter.

B. Remove substances that would bleed through finished coatings.

C. Remove finish hardware, fixture covers, and accessories and store.

D. Existing Painted and Sealed Surfaces:

1. Strip existing paint and coatings from surface.

2. Remove loose, flaking, and peeling paint. Feather edge and sand smooth edges of chipped paint.

3. Clean with mixture of trisodium phosphate and water to remove surface grease and foreign matter.

E. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent.

F. Ferrous Metal:

1. Solvent clean.

2. Remove loose rust, loose mill scale, and other foreign substances using hand tools according to SSPC-SP 2, power tools according to SSPC-SP 3 or blast cleaning according to SSPC-SP 6 or -SP 7.

G. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.

3.03 PRIMING

A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

B. Concrete and Masonry: Prior to priming, patch holes and indentations and fill cracks with manufacturer's recommended crack repair material.

3.04 COATING APPLICATION

A. Apply coatings in accordance with manufacturer's instructions, to thicknesses specified.

B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Clean surfaces immediately of overspray, splatter, and excess material.

C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.06 PROTECTION

A. Protect finished work from damage.

END OF SECTION

SECTION 09 9723
CONCRETE AND MASONRY COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Moisture resistant textured concrete and masonry coatings.

B. Moisture resistant smooth concrete and masonry coatings.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 09 9113 - Exterior Painting.

1.03 REFERENCE STANDARDS

A. ASTM D522/D522M - Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings 2017.

B. ASTM D714 - Standard Test Method for Evaluating Degree of Blistering of Paints 2002 (Reapproved 2009).

C. ASTM D968 - Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive 2017.

D. ASTM D2243 - Standard Test Method for Freeze-Thaw Resistance of Water-Borne Coatings 1995 (Reapproved 2014).

E. ASTM D4803 - Standard Test Method for Predicting Heat Buildup in PVC Building Products 2018.

F. ASTM D6904 - Standard Practice for Resistance to Wind-Driven Rain for Exterior Coatings Applied on Masonry 2003 (Reapproved 2013).

G. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.

H. SSPC-SP 2 - Hand Tool Cleaning 1982, with Editorial Revision (2004).

I. SSPC-SP 3 - Power Tool Cleaning 1982, with Editorial Revision (2004).

J. SSPC-SP 6 - Commercial Blast Cleaning 2007.

K. SSPC-SP 7 - Brush-Off Blast Cleaning 2007.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating coating materials and [_____].

C. Samples: Submit two samples 8" x 8" in size illustrating colors available for selection.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

F. Maintenance Data: Include cleaning procedures and repair and patching techniques.

1.05 QUALITY ASSURANCE

A. Maintain one copy of each referenced document that applies to application on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

C. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.06 MOCK-UP

A. Provide mock-up of each type of coating, illustrating coating, color and surface sheen, for each specified coating.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

1.07 FIELD CONDITIONS

A. Do not install materials when temperature is below 55 degrees F (13 degrees C) or above 90 degrees F (32 degrees C).

B. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.

C. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

D. Restrict traffic from area where coating is being applied or is curing.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for bond to substrate.

PART 2 PRODUCTS

2.01 CONCRETE AND MASONRY COATINGS

A. Provide high-build, weather resistant coating systems that meet the following minimum performance criteria, unless more stringent criteria are specified:

1. Salt Spray Resistance: Passes when tested according to ASTM B117 for 2000 hours.
2. Surface Burning Characteristics: Flame spread/Smoke developed index of 0/0, maximum, when tested in accordance with ASTM E84.
3. Accelerated Outdoor Exposure: Passes when tested according to ASTM G153 for 5,000 hours.

2.02 MATERIALS

A. Coatings - General: Provide complete systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated.

1. Maximum volatile organic compound (VOC) content: As required by applicable regulations.

B. High Build, One Coat, Water Based Textured Coating for 'Green' Concrete: Water based, epoxy-acrylic resin with graded perlite aggregate.

1. Stated by manufacturer as suitable for installation on visibly damp surfaces and concrete that has hardened but is not fully cured ("green" concrete) without requiring a primer.
2. Dry Film Thickness: 15 mils (0.381 mm), minimum.
3. Flexibility Test: Passing, when tested according to ASTM D522/D522M with a 1 inch (25 mm) mandrel.
4. Abrasion Resistance: Passing, when tested according to ASTM D968 with 792 gallons (3,000 L) of falling sand.
5. Freeze Thaw Resistance: Passing, when tested according to ASTM D2243 for 50 cycles.

6. Wind Driven Rain Resistance: Passing, when tested according to ASTM D6904 at 98 miles per hour (158 km/h) for 24 hours.
7. Water Vapor Transmission: 20 perms (1149 ng/Pa s sq m), maximum, when tested in accordance with ASTM E96/E96M.

C. High Build, Water Based Textured Coating System for Masonry: Water based styrene-acrylic resin primer; acrylic terpolymer (elastomeric) top coat and graded perlite aggregate.
1. Stated by manufacturer as suitable for masonry and concrete surfaces cured 28 days, minimum; cement plaster, cement fiber board, and metal.
2. Dry Film Thickness: 15 mils (0.381 mm), minimum.
3. Flexibility Test: Passing, when tested according to ASTM D522/D522M with a 1 inch (25 mm) mandrel.
4. Freeze Thaw Resistance: Passing, when tested according to ASTM D2243 for 50 cycles.
5. Water Vapor Transmission: 4.2 perms (240 ng/Pa s sq m), maximum, when tested in accordance with ASTM E96/E96M.

D. High Build, Water Based Solar Reflective Textured Coating System: Water based, acrylic latex textured primer with graded perlite aggregate and acrylic copolymer solar reflective color top coat.
1. Stated by manufacturer as suitable for masonry and concrete surfaces cured 28 days, minimum; cement plaster, cement fiber board, and metal.
2. Dry Film Thickness: 13 to 18 mils (0.330 to 0.457 mm), minimum.
3. Blistering Resistance: Passing, when tested according to ASTM D714 for 100 hours.
4. Abrasion Resistance: Passing, when tested according to ASTM D968 using 218 gallons (825 L) of falling sand.
5. Freeze Thaw Resistance: Passes when tested according to ASTM D2243 for 50 cycles.
6. Surface Temperature Reduction Based on Solar Reflectance: ASTM D4803; reduction in surface temperature increase above ambient temperature when compared to control sample of conventional acrylic paint.
    a. Light colors: 25 to 35 percent.
    b. Medium colors: 55 to 65 percent.
    c. Dark colors: 100 percent.

E. Water Based Super-Hydrophobic Smooth Coating: Single component acrylic coating, color pigments, and acrylic polymer.

F. Water Based Weather Resistant Smooth Coating: Single component acrylic coating, color pigments, and acrylic polymer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.

C. Cementitious Substrates: Do not begin application until substrate has cured 28 days minimum and measured moisture content is not greater than 16 percent.

D. Masonry: Verify masonry joints are struck flush.

3.02 PREPARATION

A. Clean surfaces of loose foreign matter.

B. Remove substances that would bleed through finished coatings.

C. Remove finish hardware, fixture covers, and accessories and store.

D. Existing Painted and Sealed Surfaces:

1. Strip existing paint and coatings from surface.
2. Remove loose, flaking, and peeling paint. Feather edge and sand smooth edges of chipped paint.
3. Clean with mixture of trisodium phosphate and water to remove surface grease and foreign matter.

E. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent.

F. Ferrous Metal:

1. Solvent clean.
2. Remove loose rust, loose mill scale, and other foreign substances using hand tools according to SSPC-SP 2, power tools according to SSPC-SP 3 or blast cleaning according to SSPC-SP 6 or -SP 7.

G. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.

3.03 PRIMING

A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

B. Concrete and Masonry: Prior to priming, patch holes and indentations and fill cracks with manufacturer's recommended crack repair material.

3.04 COATING APPLICATION

A. Apply coatings in accordance with manufacturer's instructions, to thicknesses specified.

B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Clean surfaces immediately of overspray, splatter, and excess material.

C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.06 PROTECTION

A. Protect finished work from damage.

END OF SECTION

SECTION 09 9730
DECORATIVE CEMENTITIOUS COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cementitious textured coating.

B. Cementitious micro-topping.

C. Coloring of decorative cementitious coatings.

1.02 RELATED REQUIREMENTS

A. Section 03 0100 - Maintenance of Concrete: Cleaning and resurfacing existing concrete.

B. Section 03 3000 - Cast-in-Place Concrete: Concrete mix design; bonding and chemical admixtures; mixing; placement; finishing of concrete surface to tolerance: floating, troweling, and similar operations; frequency and treatment of control joints.

C. Section 03 3511 - Concrete Floor Finishes: Colored coatings and stains.

D. Section 32 1313 - Concrete Paving: Concrete mix design; concrete placement; ambient conditions; finishing of concrete surface to tolerance: floating, troweling, and similar operations; frequency and treatment of control joints; expansion joint treatment.

1.03 REFERENCE STANDARDS

A. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete 2016.

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2017.

C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride 2016a.

D. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes 2017.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings: Indicate location of construction and control joints.

D. Samples: Submit two samples of coating , [8" x 8"] inch ([203 x 203] mm) in size, illustrating texture, color and sealing .

E. Installer's Qualification Statement.

F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.

1. Submit installer's list of completed decorative cementitious coating projects, including project name and location, name of Architect, and type and quantity of materials applied.

1.06 MOCK-UP

A. Construct mock-up of decorative cementitious coating.
   1. Use same materials and methods for use in the work.
   2. Locate where directed.
   3. Minimum Size: 4 by 4 feet (1220 mm by 1220 mm).
B. Obtain approval of mock-up by Architect before proceeding with work.
C. Mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
B. Store and handle materials according to manufacturer's instructions.
C. Keep materials in manufacturer's original, unopened containers and packaging until application.
D. Store materials in clean, dry area indoors and out of direct sunlight.
E. Keep materials from freezing.
F. Protect materials during storage, handling, and application to prevent contamination or damage.

1.08 FIELD CONDITIONS

A. Do not install materials when air and surface temperatures are below 50 degrees F (10 degrees C) or above 90 degrees F (32 degrees C).
B. Do not install materials when rain, snow, or excessive moisture is expected during application or within 24 hours after application.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Correct defective Work within a five year period after Date of Substantial Completion.
C. Provide five year manufacturer warranty for material and workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Decorative Cementitious Coatings:
   1. AVM Industries, Inc: www.avmindustries.com/#sle.
   2. BRICKFORM: www.brickform.com/#sle.
   3. Concrete Solutions by Rhino Linings: www.concretesolutions.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DECORATIVE CEMENTITIOUS COATING SYSTEMS

A. Cementitious Textured Coating: Polymer-modified concrete consisting of cement and sand aggregate mixed with acrylic admixture.
   1. Application(s): All indicated exterior locations.

2. Application Method: Trowel.
3. Texture: Trowel knock down.

B. Cementitious Micro-Topping: Thin decorative polymer-modified concrete coating consisting of cement and sand aggregate mixed with water.

1. Application(s): All indicated interior locations.
2. Application Method: Trowel.
3. Texture: Smooth.
4. Color: Stain specified in Section 03 3511.
5. Confirm compatibility of products if supplied from multiple manufacturers.
6. Products:
    a. Substitutions: See Section 01 6000 - Product Requirements.

2.03 MATERIALS

A. Primer: Water-based epoxy as recommended by decorative cementitious coating manufacturer; compatible with substrate and coating.

B. Concrete Mix: Manufacturer's standard sand and Portland cement mix.

C. Acrylic Admixture: Manufacturer's recommended liquid polymer.

D. Integral Colorant: Dry powder mineral pigments for mixing into concrete coating.

E. Concrete Stain: Translucent penetrating compound for interior or exterior use, intended to be finished with a sealer.

1. Do not use hydrochloric acid products.
2. Application Method: Spray or brush.

F. Sealer: Suitable for interior and exterior application.

1. Composition: Acrylic, water-based.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces and areas to receive decorative cementitious coatings.

B. Verify that concrete sub-floor surfaces are ready for cementitious coating by testing for moisture and alkalinity; obtain instructions if test results are not within the following limits:

1. Moisture Vapor Emission: Maximum of 5.0 pounds (2.26 kg) per 1000 square feet (92.9 square meters) over a 24 hour test period, tested according to ASTM F1869.
2. Relative Humidity: Maximum of 75 percent, tested according to ASTM F2170.
3. Alkalinity: pH range of 5 to 9, tested according to ASTM F710.

C. Notify Architect of conditions that would adversely affect application or subsequent use.

D. Do not begin preparation or application until unacceptable conditions are corrected.

3.02 PREPARATION

A. Protect adjacent non-coated areas from drips, overflow, and overspray.

B. See Section 03 0100 for cleaning and resurfacing of existing concrete.

C. Profile concrete substrate to surface profile according to manufacturer's instructions.

3.03 INSTALLATION

A. Prepare joints and repair damaged or deteriorated concrete. Fill cracks, bugholes, spalls, and infill low areas according to coating manufacturer's instructions.

B. Mix and install coating according to with manufacturer's instructions.

C. Match approved mock-ups for color, texture, sealing and workmanship.

D. Add integral concrete pigment to concrete mixture where indicated. Mix according to pigment and coating manufacturers' instructions.

E. Protect recently placed materials from premature drying, excessive hot or cold temperatures and mechanical injury until fully cured.

F. Do not use curing compounds on decorative cementitious coatings; air cure according to manufacturer's instructions.

G. Ventilate interior spaces to remove excess moisture.

H. Cure decorative cementitious coating for a minimum of 24 hours before applying stain. Apply concrete stain according to manufacturer's instructions.

I. Apply sealer uniformly over entire surface and according to manufacturer's instructions.

3.04 PROTECTION

A. Do not allow traffic on finished surfaces for the following periods after application:

1. Foot Traffic: Minimum 24 hours.
2. Heavy Traffic: Minimum 72 hours.

B. Protect finished work from damage during construction and ensure that, except for normal weathering, work will be without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 09 9730
DECORATIVE CEMENTITIOUS COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cementitious textured coating.

B. Cementitious micro-topping.

C. Coloring of decorative cementitious coatings.

1.02 RELATED REQUIREMENTS

A. Section 03 0100 - Maintenance of Concrete: Cleaning and resurfacing existing concrete.

B. Section 03 3000 - Cast-in-Place Concrete: Concrete mix design; bonding and chemical admixtures; mixing; placement; finishing of concrete surface to tolerance: floating, troweling, and similar operations; frequency and treatment of control joints.

C. Section 03 3511 - Concrete Floor Finishes: Colored coatings and stains.

D. Section 32 1313 - Concrete Paving: Concrete mix design; concrete placement; ambient conditions; finishing of concrete surface to tolerance: floating, troweling, and similar operations; frequency and treatment of control joints; expansion joint treatment.

1.03 REFERENCE STANDARDS

A. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete 2016.

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2017.

C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride 2016a.

D. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes 2017.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to start of work of this section; require attendance by all affected installers.

1. Review mock-ups, material sequence, preparation and application, cleaning, protection and coordination with other work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.

2. Storage and handling requirements and recommendations.

3. Installation methods.

C. Shop Drawings: Indicate location of construction and control joints.

D. Samples: Submit two samples of coating , [8" x 8"] inch ([203 x 203] mm) in size, illustrating texture, color and sealing .

E. Pre-Installation Test Reports: Submit test results to Architect for evaluation.

F. Installer's Qualification Statement.

G. Testing Agency Qualification Statement.

H. Maintenance Data: Provide manufacturer's data on maintenance and renewal of applied finishes.

I. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.

1. Submit installer's list of completed decorative cementitious coating projects, including project name and location, name of Architect, and type and quantity of materials applied.

B. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.07 MOCK-UP

A. Construct mock-up of decorative cementitious coating.

1. Use same materials and methods for use in the work.
2. Locate where directed.
3. Minimum Size: 4 by 4 feet (1220 mm by 1220 mm).

B. Obtain approval of mock-up by Architect before proceeding with work.

C. Mock-up may remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store and handle materials according to manufacturer's instructions.

C. Keep materials in manufacturer's original, unopened containers and packaging until application.

D. Store materials in clean, dry area indoors and out of direct sunlight.

E. Keep materials from freezing.

F. Protect materials during storage, handling, and application to prevent contamination or damage.

1.09 FIELD CONDITIONS

A. Do not install materials when air and surface temperatures are below 50 degrees F (10 degrees C) or above 90 degrees F (32 degrees C).

B. Do not install materials when rain, snow, or excessive moisture is expected during application or within 24 hours after application.

1.10 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty for material and workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Decorative Cementitious Coatings:

1. AVM Industries, Inc: www.avmindustries.com/#sle.
2. BRICKFORM: www.brickform.com/#sle.
3. Concrete Solutions by Rhino Linings: www.concretesolutions.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DECORATIVE CEMENTITIOUS COATING SYSTEMS

A. Cementitious Textured Coating: Polymer-modified concrete consisting of cement and sand aggregate mixed with acrylic admixture.
   1. Application(s): All indicated exterior locations.
   2. Application Method: Trowel.
   3. Texture: Trowel knock down.

B. Cementitious Micro-Topping: Thin decorative polymer-modified concrete coating consisting of cement and sand aggregate mixed with water.
   1. Application(s): All indicated interior locations.
   2. Application Method: Trowel.
   3. Texture: Smooth.
   4. Color: Stain specified in Section 03 3511.
   5. Confirm compatibility of products if supplied from multiple manufacturers.
   6. Products:
      a. Substitutions: See Section 01 6000 - Product Requirements.

2.03 MATERIALS

A. Primer: Water-based epoxy as recommended by decorative cementitious coating manufacturer; compatible with substrate and coating.

B. Concrete Mix: Manufacturer's standard sand and Portland cement mix.

C. Acrylic Admixture: Manufacturer's recommended liquid polymer.

D. Integral Colorant: Dry powder mineral pigments for mixing into concrete coating.

E. Concrete Stain: Translucent penetrating compound for interior or exterior use, intended to be finished with a sealer.
   1. Do not use hydrochloric acid products.
   2. Application Method: Spray or brush.

F. Sealer: Suitable for interior and exterior application.
   1. Composition: Acrylic, water-based.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces and areas to receive decorative cementitious coatings.

B. Verify that concrete sub-floor surfaces are ready for cementitious coating by testing for moisture and alkalinity; obtain instructions if test results are not within the following limits:
   1. Moisture Vapor Emission: Maximum of 5.0 pounds (2.26 kg) per 1000 square feet (92.9 square meters) over a 24 hour test period, tested according to ASTM F1869.

2. Relative Humidity: Maximum of 75 percent, tested according to ASTM F2170.
3. Alkalinity: pH range of 5 to 9, tested according to ASTM F710.

C. Notify Architect of conditions that would adversely affect application or subsequent use.

D. Do not begin preparation or application until unacceptable conditions are corrected.

3.02 PREPARATION

A. Protect adjacent non-coated areas from drips, overflow, and overspray.

B. See Section 03 0100 for cleaning and resurfacing of existing concrete.

C. Profile concrete substrate to surface profile according to manufacturer's instructions.

3.03 INSTALLATION

A. Prepare joints and repair damaged or deteriorated concrete. Fill cracks, bugholes, spalls, and infill low areas according to coating manufacturer's instructions.

B. Mix and install coating according to with manufacturer's instructions.

C. Match approved mock-ups for color, texture, sealing and workmanship.

D. Add integral concrete pigment to concrete mixture where indicated. Mix according to pigment and coating manufacturers' instructions.

E. Protect recently placed materials from premature drying, excessive hot or cold temperatures and mechanical injury until fully cured.

F. Do not use curing compounds on decorative cementitious coatings; air cure according to manufacturer's instructions.

G. Ventilate interior spaces to remove excess moisture.

H. Cure decorative cementitious coating for a minimum of 24 hours before applying stain. Apply concrete stain according to manufacturer's instructions.

I. Apply sealer uniformly over entire surface and according to manufacturer's instructions.

3.04 PROTECTION

A. Do not allow traffic on finished surfaces for the following periods after application:

1. Foot Traffic: Minimum 24 hours.
2. Heavy Traffic: Minimum 72 hours.

B. Protect finished work from damage during construction and ensure that, except for normal weathering, work will be without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 10 1101
VISUAL DISPLAY BOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Chalkboards, Markerboards and Tackboards.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Blocking and supports.

B. Section 06 2000 - Finish Carpentry: Wood frame and chalkrails.

C. Section 09 2116 - Gypsum Board Assemblies: Concealed supports in metal stud walls.

D. Section 09 2216 - Non-Structural Metal Framing: Concealed supports in metal stud walls.

E. Section 09 9123 - Interior Painting: Finishing of wood frame and chalkrail.

F. Section 10 2239 - Folding Panel Partitions: Installation of visual display boards on operable partitions.

1.03 REFERENCE STANDARDS

A. ANSI A135.4 - American National Standard for Basic Hardboard 2012.

B. ANSI A208.1 - American National Standard for Particleboard 2009.

C. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling 2018.

D. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board 2012.

E. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2018b.

G. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics 2015.

H. PS 1 - Structural Plywood 2009.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data on chalkboard, markerboard, tackboard, tackboard surface covering, trim and accessories.

C. Shop Drawings: Indicate wall elevations, dimensions, joint locations , special anchor details.

D. Samples: Submit color charts for selection of color and texture of chalkboard, markerboard, tackboard, tackboard surface covering and trim.

E. Test Reports: Show compliance to specified surface burning characteristics requirements.

F. Manufacturer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year warranty for chalkboard and markerboard to include warranty against discoloration due to cleaning, crazing or cracking and staining.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Visual Display Boards:

1. Claridge Products and Equipment, Inc; [____]: www.claridgeproducts.com/#sle.
2. MooreCo, Inc; [____]: www.moorecoinc.com/#sle.
3. Polyvision Corporation (Nelson Adams); [____]: www.polyvision.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 VISUAL DISPLAY BOARDS

A. Markerboards: Porcelain enamel on steel, laminated to core.

1. Color: As selected from manufacturer's full range.
2. Steel Face Sheet Thickness: 24 gage, 0.0239 inch (0.61 mm).
3. Core: Particleboard, manufacturer's standard thickness, laminated to face sheet.
4. Backing: Aluminum foil, laminated to core.
5. Size: As indicated on drawings.
6. Frame Profile: As indicated on drawings
7. Accessories: Provide chalk tray and map rail.

B. Tackboards: [____].

1. Cork Thickness: 1/8 inch (3 mm).
2. Fabric: Vinyl coated fabric.
3. Backing: Hardboard, 1/4 inch (6 mm) thick, laminated to tack surface.
4. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.
5. Size: As indicated on drawings.
6. Frame: Extruded aluminum , with concealed fasteners.
7. Frame Profile: As indicated on drawings
8. Frame Finish: Anodized, natural.
9. Accessories: Provide map rail.

C. Combination Units and Units Made of More Than One Panel: Factory-assembled chalkboards, markerboards and tackboards in a single frame, of materials specified above.

1. Join panels of different construction with H-shaped extruded aluminum molding finished to match frame.
2. Configuration: As indicated on drawings.
3. Units Too Large to Ship Assembled: Fully assembled in factory, then disassembled for shipping.

2.03 MATERIALS

A. Porcelain Enameled Steel Sheet: ASTM A424/A424M, Type I, Commercial Steel, with fired-on vitreous finish.

B. Hardboard for Chalk Surface: ANSI A135.4 Tempered type.

C. Vinyl Coated Fabric: ASTM F793 Category VI.

D. Burlap: Tightly woven, flame retardant treated.

E. Plywood: PS 1 Grade C-D , softwood.

F. Hardboard for Cores: ANSI A135.4, Class 1 - Tempered, S2S (smooth two sides).

G. Particleboard: ANSI A208.1; wood chips, set with waterproof resin binder, sanded faces.

H. Gypsum Board: ASTM C1396/C1396M, paper/foil faced, plain type.

I. Fiber Board: ASTM C208, cellulosic fiber board.

J. Foil Backing: Aluminum foil sheet, 0.005 inch thick (0.13 mm thick).

K. Aluminum Sheet Backing: 27 gage, 0.014 inch (0.36 mm) thick.

L. Steel Sheet Backing: 28 gage, 0.0149 inch (0.38 mm), galvanized.

M. Adhesives: Type used by manufacturer.

2.04 ACCESSORIES

A. Wood Frames: See Section 062000.

B. Map Rail: Extruded aluminum, manufacturer's standard profile, with cork insert and runners for accessories; 1 inch wide overall (; 25 mm wide overall) , full width of frame.

C. Map Supports: Formed aluminum sliding hooks and roller brackets to fit map rail.

D. Temporary Protective Cover: Sheet polyethylene, 8 mil (0.2 mm) thick.

E. Flag Holders: Cast aluminum bored to receive 1 inch (25 mm) diameter flag staff, bracketed to fit top rail of board.

F. Chalk Tray: Wood; species and finish to match frame, style as indicated on drawings.

G. Mounting Brackets: Concealed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

C. Verify flat wall surface for frameless adhesive-applied boards.

3.02 INSTALLATION

A. Install boards in accordance with manufacturer's instructions.

B. Secure units level and plumb.

C. Butt Joints: Install with tight hairline joints.

D. Carefully cut holes in boards for thermostats.

3.03 CLEANING

A. Clean board surfaces in accordance with manufacturer's instructions.

B. Cover with protective cover, taped to frame.

C. Remove temporary protective cover at Date of Substantial Completion.

3.04 SCHEDULE

A. Classroom 312: Two 48 by 96 inch (1200 mm by 2400 mm) chalkboards with chalkrails, two map hooks and one flag holder on the north wall; one 48 by 96 inch (1200 mm by 2400 mm) chalkboard without chalkrail on the east wall; one 48 by 96 inch (1200 mm by 2400 mm) tackboard on the south wall.

B. Classroom 313: Same as Classroom 312 except no tackboard.

C. Lecture 314: One 48 by 96 inch (1200 mm by 2400 mm) markerboard with chalkrail, one 48 by 96 inch (1200 mm by 2400 mm) markerboard without rail on the east wall.

END OF SECTION

SECTION 10 1124
TACKABLE WALL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Site fabricated, fabric-covered tackable wall system.

B. Accessories as required for complete installation.

C. Maintenance.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 09 7200 - Wall Coverings: Fabric wall coverings for adhesive application to solid wall surfaces.

C. Section 10 1101 - Visual Display Boards: Prefabricated, framed tackboards and markerboards.

1.03 REFERENCE STANDARDS

A. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use 2009.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.
4. Specimen warranty.

C. Shop Drawings: Elevations indicating proposed locations of fabric seams and details indicating typical transitions to other finish surfaces.

D. Verification Samples:

1. Actual samples of all track profiles to be employed, including transitions between dissimilar profiles.
2. Tackable core backing material, minimum 12 inches (300 mm) square.
3. Accessory package.

E. Test Reports: Certified test data from an independent test agency verifying that wall systems meet specified requirements for fire performance.

F. Maintenance Contract.

G. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner 's name and registered with manufacturer.

H. Maintenance Materials: Furnish the following for Owner 's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide components of tackable wall systems by single manufacturer, including recommended primers, adhesives, and sealants.

B. Installer Qualifications: Firm specializing in site-fabricated wall systems, with not less than five years of documented experience in installing wall systems of the type specified, and approved by the

manufacturer.

C. Mock-Up: Provide a mock-up for evaluation of application workmanship.

1. Finish areas designated by Architect .
2. Do not proceed with remaining work until workmanship and overall appearance are approved by Architect .
3. Refinish mock-up area as required to produce acceptable workmanship.
4. Approved mock-up may remain as part of the completed Work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect fabric, core, and track from excessive moisture in shipment, storage, and handling. Do not deliver materials to project until wet work such as concrete and plaster has been completed.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

A. Do not begin installation until interior conditions have reached temperature and humidity that will be maintained during occupancy. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Tackable Wall Systems:

1. Fabricmate Systems: www.fabricmate.com/#sle.
2. FabriTRAK Systems, Inc; [_____]: www.fabritrak.com/#sle.
3. Fabric Wall; [_____]: www.fabric-wall.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 TACKABLE WALL SYSTEM

A. Tackable Wall System: Site-installed stretched fabric over tackable core and continuous perimeter and intermediate mounting extrusions applied directly to wall surface; designed to permit removal and replacement of fabric in individual panels without affecting adjacent panels.

1. Surface Burning Characteristics: Flame Spread Index of 25, maximum; Smoke Developed Index of 450, maximum; when whole system is tested in accordance with ASTM E84 using mounting specified in ASTM E2573 for stretched systems.
2. Prefabricated framed panels are not acceptable.
3. Fabric must be installed over tackable substrate without adhesives, tapes, or fasteners.
4. Seams in fabric are not permitted; adjust the layout of frames to suit fabric width; obtain approval of Architect.

B. Verify that all adhesives and sealants employed in installation of tackable wall systems are low-emission types, with low VOC ratings.

2.03 MATERIALS

A. Frame: Extruded polymer track system with serrated jaws of sufficient strength to hold fabric in place after repeated applications.

1. Track Size: 3/8 inch (9.5 mm) protrusion from wall with minimum 1 inch (25 mm) base leg.
2. Track Shape: Square at perimeter; square at intermediate abutting joints.
3. Wall Thickness of Track: Minimum 0.062 inch (1.575 mm).
4. Color: As selected from manufacturer's standards.

B. Core: Same thickness as track.

1. Material: Multi-density fiberglass board, consisting of a facing sheet of 12 pounds per cubic foot (192 kg/cu m) density board laminated over 3 pounds per cubic foot (48 kg/cu m) density board.
2. Material: Medium density wood fiberboard, 14 to 16 pcf (224 to 256 kg/cu m) density, fire-retardant, complying with ANSI A208.2.

C. Fabric: Heavy-duty fire-retardant commercial fabric, as provided by manufacturer of tackable wall system; color, pattern, and texture as selected from manufacturer's standards.

D. Fasteners: As recommended by manufacturer of tackable wall system for project conditions.

E. Adhesives: Low VOC or water-based, approved by wall system manufacturer, and complying with requirements of Section 01 6116.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Verify that all casework, markerboards, door and window jambs, finished ceiling, and other finished items abutting tackable wall systems have been installed.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove wall plates and other obstacles, and prepare substrates to receive core material in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. Install tackable wall systems at locations indicated, complying with manufacturer's instructions.

B. Track: Install perimeter and intermediate track using fasteners appropriate to substrate, securing firmly to prevent track separation from substrate.

1. Follow contours of wall and scribe to adjoining work at borders, penetrations, and imperfections.
2. Install track around openings and penetrations.
3. Allow for spacing to accommodate insertion of installation tool.

C. Core Material: Cut core material to fit snugly within frame perimeter. Apply manufacturer's recommended, non-toxic, low-vapor, clay-base adhesive, and press core material into place, maintaining constant plane.

Staple core material to prevent air gaps and to maintain secure contact for full adhesion.

1. At fixtures mounted within area of tackable wall system, install MDF for backing and to maintain fixture surface flush with tackable panels.

D. Fabric: Stretch fabric over core material, locking fabric edges into track's serrated jaws using manufacturer's recommended tool. Keep fabric weave plumb, level, and true, in proper relation to building lines, without ripples, waviness, hourglass, or other deleterious effects.

1. Seams are not permitted.
2. In installing fabric, do not employ adhesives or mechanical fasteners of any type, assuring that the fabric is free-floating and in firm contact with core material.
3. Tension fabric sufficiently to prevent sagging under anticipated changes in temperature and humidity.

3.04 CLEANING

A. Clean exposed surfaces of tackable wall system, complying with manufacturer's instructions for cleaning and repair of minor finish damage. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

3.05 PROTECTION

A. Protect installed products until completion of project, using methods that will ensure that the finished work will be without damage or deterioration at Date of Substantial Completion.

3.06 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Replace damaged, soiled, or vandalized tackable wall panels for up to three years from Date of Substantial Completion.

C. Replacement of up to 10 percent of the originally installed panels shall be at no additional cost to Owner .

D. Replacement of defective panels covered under warranty provisions is not included in this maintenance service.

END OF SECTION

SECTION 10 1400
SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cash allowance for signs.

B. Room and door signs.

C. Interior directional and informational signs.

D. Luminous egress path marking and other "glow-in-the-dark" signs.

E. Emergency evacuation maps.

F. Building identification signs.

G. Plaque.

H. Traffic signs.

1.02 RELATED REQUIREMENTS

A. Section 05 5100 - Metal Stairs: Photoluminescent stair nosings.

B. Section 05 5213 - Pipe and Tube Railings: Photoluminescent handrail strips.

C. Section 22 0553 - Identification for Plumbing Piping and Equipment.

D. Section 26 0553 - Identification for Electrical Systems.

E. Section 26 5100 - Interior Lighting: Exit signs required by code.

1.03 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines current edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

D. ASTM E2072 - Standard Specification for Photoluminescent (Phosphorescent) Safety Markings 2014.

E. UL 1994 - Luminous Egress Path Marking Systems Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3300 – Submittal Procedures, for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.

1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.

2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.

3. Submit for approval by Owner through Architect prior to fabrication.

D. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.

E. Maintenance Materials: Furnish the following for Owner 's use in maintenance of project.

1. Curved Sign Media Suction Cups: One for each 100 signs; for removing media.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

C. Store tape adhesive at normal room temperature.

1.07 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flat Signs:

1. Best Sign Systems, Inc: www.bestsigns.com.
2. Cosco Industries (ADA signs); ADA Series 1: www.coscoarchitecturalsigns.com.
3. Cosco Industries (non-ADA signs); Changeable Message Signs: www.coscoarchitecturalsigns.com.
4. FASTSIGNS: www.fastsigns.com.
5. Substitutions: See Section 01 2500 – Substitution Procedures.

B. Curved Signs:

1. FASTSIGNS: www.fastsigns.com.
2. Vista System, www.vistasystem.com.
3. Substitutions: See Section 01 2500 – Substitution Procedures.

C. Dimensional Letter Signs:

1. Cosco Industries; Cast Aluminum: www.coscoarchitecturalsigns.com.
2. FASTSIGNS: www.fastsigns.com.
3. Inpro www.inprocorp.com.
4. Substitutions: See Section 01 2500 – Substitution Procedures.

D. Plaques:

1. Cosco Industries; Cast Aluminum: www.coscoarchitecturalsigns.com.
2. FASTSIGNS; [____]: www.fastsigns.com.
3. [_____].
4. Substitutions: See Section 01 2500 – Substitution Procedures.

E. Photoluminescent Marking and Signage:

1. Ecoglo, Inc; [___]: www.us.ecoglo.com.
2. Safe-T-Nose, LLC; [_____]: www.safetnose.com.
3. [_____].

2.02 SIGNAGE APPLICATIONS

A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.

1. Sign Type: Flat signs with engraved panel media as specified.
2. Provide "tactile" signage, with letters raised minimum 1/32 inch (0.8 mm) and Grade II braille.
3. Character Height: 1 inch (25 mm).
4. Sign Height: 2 inches (50 mm), unless otherwise indicated.
5. Office Doors: Identify with room numbers to be determined later, not the numbers indicated on drawings; in addition, provide "window" section for replaceable occupant name.
6. Conference and Meeting Rooms: Identify with room numbers to be determined later, not the numbers indicated on drawings; in addition, provide "window" section with sliding "In Use/Vacant" indicator.
7. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
8. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers to be determined later, and braille.

C. Interior Directional and Informational Signs:

1. Sign Type: Curved signs with engraved panel media as specified.
2. Sizes: As indicated on drawings.
3. Wording of signs is scheduled on drawings.
4. Where suspended, ceiling mounted, or projecting from wall signs are indicated, provide two-sided signs with same information on both sides.

D. Luminous Egress Path Marking and Other "Glow-in-the-Dark" Signs: Photoluminescent media.

1. Provide luminous egress path marking as required by local authority having jurisdiction.
2. Provide one numbered seat marker for each seat in auditorium and one numbered row marker for each row, each side of aisles.

E. Emergency Evacuation Maps:

1. Allow for one map per elevator lobby.
2. Map content to be provided by Owner.

F. Building Identification Signs:

1. Use individual metal letters.
2. Mount on outside wall in location indicated on drawings.

G. Other Dimensional Letter Signs: Wall-mounted.

H. Plaque: See Allowance for details.

I. Traffic Signs: To match campus standards; locate where indicated on drawings.

2.03 SIGN TYPES

A. Flat Signs: Signage media without frame.

1. Edges: Square.

2. Corners: Square.
3. Wall Mounting of One-Sided Signs: Tape adhesive.
4. Wall and Ceiling Mounting of Two-Sided Signs: Aluminum wall bracket, powder coated, color selected from manufacturer's standard colors, attached with screws in predrilled mounting holes, set in clear silicone sealant.
5. Suspended Mounting: Stainless steel suspension cables, cable clamps, and ceiling fastener suitable for attachment to ceiling construction indicated.

B. Radius / Curved Signs: One-piece, curved extruded aluminum media holder securing flat, flexible sign media by curved lip on two sides; other two sides closed by end caps; concealed mounting attachment.
1. Sizes: As indicated on drawings.
2. Finish: Natural (clear) anodized.
3. Sign Orientation: Curved in horizontal section.
4. Wall Mounting of One-Sided Signs: Mechanical anchorage, with predrilled holes, and set in clear silicone sealant.
5. Wall and Ceiling Mounting of Two-Sided Signs: Aluminum wall bracket, powder coated, color selected from manufacturer's standard colors, attached with screws in predrilled mounting holes, set in clear silicone sealant.
6. Suspended Mounting: Stainless steel suspension cables, cable clamps, and ceiling fastener suitable for attachment to ceiling construction indicated.

C. Color and Font: Unless otherwise indicated:
1. Character Font: Helvetica, Arial, or other sans serif font.
2. Character Case: Upper case only.
3. Background Color: Clear.
4. Character Color: Contrasting color.

2.04 TACTILE SIGNAGE MEDIA

A. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:
1. Total Thickness: 1/16 inch (1.6 mm).

2.05 PLAQUES

A. Metal Plaques:
1. Metal: Aluminum casting.
2. Metal Sheet Thickness: 1/8 inch (3 mm), minimum.

2.06 DIMENSIONAL LETTERS

A. Metal Letters:
1. Mounting: Tape adhesive.

B. Plastic Letters:
1. Mounting: Tape adhesive.

2.07 PHOTOLUMINESCENT MEDIA

A. Extruded Aluminum Guidance Strips:
1. Complies with UL 1994 and ASTM E2072.
2. Mounting: As recommended by manufacturer for material selected.

B. Sheet Aluminum Guidance Strips:

1. Complies with UL 1994 and ASTM E2072.
2. Mounting: As recommended by manufacturer for material selected.

C. High-Impact Plastic Guidance Strips:

1. Complies with ASTM E2072.
2. Width: 1 inch (26 mm).
3. Mounting: As recommended by manufacturer for material selected.

D. Polyester Tape Guidance Strips:

1. Complies with UL 1994 and ASTM E2072.
2. Width: 1/2 inch (12.5 mm).

E. Obstruction Strips: Black/luminous stripe marking on sheet aluminum.

1. Complies with UL 1994 and ASTM E2072.
2. Width: 1/2 inch (12.5 mm).
3. Mounting: As recommended by manufacturer for material selected.

F. Photoluminescent Stair Nosings: Factory fabricated aluminum extrusion with replaceable embedded photoluminescent and slip-resistant strip.

1. Complies with UL 1994 and ASTM E2072.
2. Finish: Anodized.
3. Mounting: Provide manufacturer approved field applied adhesive, factory applied adhesive and mechanical fasteners.

2.08 ACCESSORIES

A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.

B. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

D. Protect from damage until Substantial Completion; repair or replace damaged items.

3.03 SCHEDULE

A. The following Schedule of Signage indicates description, quantity and type of signage required.

B. Sign Type: A

1. Description: Acrylic sign and backplate with tactile room name, number and braille, with 2" high x 9" wide window for printed paper insert, one standard background and contrasting copy color.
2. Size: 6" high x 9" wide
3. Quantity: 8

4. Locations: Offices

C. Sign Type: B

1. Description: Acrylic plaque, with backplate with tactile room name, number and braille
2. Size: 6" high x 9" wide
3. Quantity: 70
4. Locations: Classrooms, Instructional Rooms, Staff Rooms

D. Sign Type: C

1. Description: Acrylic plaque, with backplate with tactile room name, number and braille
2. Size: 6" high x 6" wide.
3. Quantity: 60
4. Locations: Secondary Room Signs, Mechanical, Custodial

E. Sign Type: D

1. Description: Same as Type B but with sliding “In-Use”/ “Vacant” window
2. Size: 6" high x 9" wide
3. Quantity: 2
4. Locations: Conference Rooms

F. Sign Type: E1

1. Description: Either Men or Women accessible toilet room, with accessibility pictogram and male or female pictogram
2. Size: 9" high x 6" wide
3. Quantity: 6
4. Locations: Male or Female Toilet Rooms

G. Sign Type E2

1. Description: accessible gender-neutral toilet room, with accessibility pictogram only
2. Size: 9" high x 6" wide
3. Quantity: 45
4. Locations: Unisex or Gender-neutral Toilet Rooms

H. Sign Type: F

1. Description: Stair Entrance with stair pictogram
2. Size: 9" high x 9" wide
3. Quantity: 10
4. Locations: Stairs

I. Sign Type: G

1. Description: In Case of Fire Do Not Use Elevator Use Stair with pictogram
2. Size: 9" high x 9" wide
3. Quantity: 2
4. Locations: Elevator

J. Sign Type: H

1. Description: Occupancy Capacity Signs
2. Size: 3" high x 9" wide.
3. Quantity: 6
4. Locations: Provide one occupancy capacity sign at mounted at the main entrance to each assembly space below the room name and number. Verify location with the Architect.

K. Sign Type: J

1. Description: All visitors must report to the administration office prior to entry to building.
2. Size: 8" high x 12" wide.
3. Quantity: 10
4. Locations: All exterior doors of building

L. Sign Type: K

1. Description: Digitally produced and laminated sign with building foot print, indicating major areas of the building and direction arrows.
2. Size: 22" high x 28" wide.
3. Quantity: 8
4. Locations: to be determined by the Architect and Owner
5. Framed sign equal to Display-World sign frame SEO-5107. Wall hung, one sided, with rounded corners, silver in color. Display-World (800)733-3545

M. Sign Type: L

1. Description: Tactile Exit Signs
2. 9” high x 9” wide
3. Quantity: 50
4. Locations: Provide one tactile exit sign mounted on the wall adjacent to each door to an egress, stairwell, exit passage and exit discharge.

N. Sign Type: M

1. Description: Fire Evacuation with Floor Plan
2. Size: 11" high x 11" wide sleeve to include 8-1/2" x 11" paper insert.
3. Quantity: 57
4. Locations: Classrooms, Teaching Areas, Assembly Spaces

END OF SECTION

SECTION 10 1400
SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cash allowance for signs.

B. Room and door signs.

C. Interior directional and informational signs.

D. Luminous egress path marking and other "glow-in-the-dark" signs.

E. Emergency evacuation maps.

F. Building identification signs.

G. Plaque.

H. Traffic signs.

1.02 RELATED REQUIREMENTS

A. Section 05 5100 - Metal Stairs: Photoluminescent stair nosings.

B. Section 05 5213 - Pipe and Tube Railings: Photoluminescent handrail strips.

C. Section 22 0553 - Identification for Plumbing Piping and Equipment.

D. Section 26 0553 - Identification for Electrical Systems.

E. Section 26 5100 - Interior Lighting: Exit signs required by code.

1.03 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines current edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

D. ASTM E2072 - Standard Specification for Photoluminescent (Phosphorescent) Safety Markings 2014.

E. UL 1994 - Luminous Egress Path Marking Systems Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.

1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.

2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.

3. Submit for approval by Owner through Architect prior to fabrication.

D. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.

E. Maintenance Materials: Furnish the following for Owner 's use in maintenance of project.

1. Curved Sign Media Suction Cups: One for each 100 signs; for removing media.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

C. Store tape adhesive at normal room temperature.

1.07 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flat Signs:

1. Best Sign Systems, Inc: www.bestsigns.com/#sle.
2. Cosco Industries (ADA signs); ADA Series 1: www.coscoarchitecturalsigns.com/#sle.
3. Cosco Industries (non-ADA signs); Changeable Message Signs: www.coscoarchitecturalsigns.com/#sle.
4. FASTSIGNS: www.fastsigns.com/#sle.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Curved Signs:

1. FASTSIGNS: www.fastsigns.com/#sle.
2. Vista System, www.vistasystem.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

C. Dimensional Letter Signs:

1. Cosco Industries; Cast Aluminum: www.coscoarchitecturalsigns.com/#sle.
2. FASTSIGNS: www.fastsigns.com/#sle.
3. Inpro www.inprocorp.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

D. Plaques:

1. Cosco Industries; Cast Aluminum: www.coscoarchitecturalsigns.com/#sle.
2. FASTSIGNS; [_____]: www.fastsigns.com/#sle.
3. [_____].
4. Substitutions: See Section 01 6000 - Product Requirements.

E. Photoluminescent Marking and Signage:

1. Ecoglo, Inc; [____]: www.us.ecoglo.com/#sle.
2. Safe-T-Nose, LLC; [_____]: www.safetnose.com/#sle.
3. [_____].

2.02 SIGNAGE APPLICATIONS

A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.

1. Sign Type: Flat signs with engraved panel media as specified.
2. Provide "tactile" signage, with letters raised minimum 1/32 inch (0.8 mm) and Grade II braille.
3. Character Height: 1 inch (25 mm).
4. Sign Height: 2 inches (50 mm), unless otherwise indicated.
5. Office Doors: Identify with room numbers to be determined later, not the numbers indicated on drawings; in addition, provide "window" section for replaceable occupant name.
6. Conference and Meeting Rooms: Identify with room numbers to be determined later, not the numbers indicated on drawings; in addition, provide "window" section with sliding "In Use/Vacant" indicator.
7. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
8. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers to be determined later, and braille.

C. Interior Directional and Informational Signs:

1. Sign Type: Curved signs with engraved panel media as specified.
2. Sizes: As indicated on drawings.
3. Wording of signs is scheduled on drawings.
4. Where suspended, ceiling mounted, or projecting from wall signs are indicated, provide two-sided signs with same information on both sides.

D. Luminous Egress Path Marking and Other "Glow-in-the-Dark" Signs: Photoluminescent media.

1. Provide luminous egress path marking as required by local authority having jurisdiction.
2. Provide one numbered seat marker for each seat in auditorium and one numbered row marker for each row, each side of aisles.

E. Emergency Evacuation Maps:

1. Allow for one map per elevator lobby.
2. Map content to be provided by Owner .

F. Recognition/Donor Panels: Engraved panel media; individual name signs attached with magnetic tape to fixed panel.

1. Dimensions and Number of Name Signs: As indicated on drawings.

2. Provide all name signs whether engraved or not, for uniform overall appearance.
3. Color: Color as selected.

G. Building Identification Signs:
1. Use individual metal letters.
2. Mount on outside wall in location indicated on drawings.

H. Other Dimensional Letter Signs: Wall-mounted.

I. Plaque: See Allowance for details.

J. Traffic Signs: To match campus standards; locate where indicated on drawings.

2.03 SIGN TYPES

A. Flat Signs: Signage media without frame.
1. Edges: Square.
2. Corners: Square.
3. Wall Mounting of One-Sided Signs: Tape adhesive.
4. Wall and Ceiling Mounting of Two-Sided Signs: Aluminum wall bracket, powder coated, color selected from manufacturer's standard colors, attached with screws in predrilled mounting holes, set in clear silicone sealant.
5. Suspended Mounting: Stainless steel suspension cables, cable clamps, and ceiling fastener suitable for attachment to ceiling construction indicated.

B. Radius / Curved Signs: One-piece, curved extruded aluminum media holder securing flat, flexible sign media by curved lip on two sides; other two sides closed by end caps; concealed mounting attachment.
1. Sizes: As indicated on drawings.
2. Finish: Natural (clear) anodized.
3. Sign Orientation: Curved in horizontal section.
4. Wall Mounting of One-Sided Signs: Mechanical anchorage, with predrilled holes, and set in clear silicone sealant.
5. Wall and Ceiling Mounting of Two-Sided Signs: Aluminum wall bracket, powder coated, color selected from manufacturer's standard colors, attached with screws in predrilled mounting holes, set in clear silicone sealant.
6. Suspended Mounting: Stainless steel suspension cables, cable clamps, and ceiling fastener suitable for attachment to ceiling construction indicated.

C. Color and Font: Unless otherwise indicated:
1. Character Font: Helvetica, Arial, or other sans serif font.
2. Character Case: Upper case only.
3. Background Color: Clear.
4. Character Color: Contrasting color.

2.04 TACTILE SIGNAGE MEDIA

A. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:
1. Total Thickness: 1/16 inch (1.6 mm).

2.05 NON-TACTILE SIGNAGE MEDIA

2.06 PLAQUES

A. Metal Plaques:

1. Metal: Aluminum casting.
2. Metal Sheet Thickness: 1/8 inch (3 mm), minimum.

2.07 DIMENSIONAL LETTERS

A. Metal Letters:

1. Mounting: Tape adhesive.

B. Plastic Letters:

1. Mounting: Tape adhesive.

2.08 PHOTOLUMINESCENT MEDIA

A. Extruded Aluminum Guidance Strips:

1. Complies with UL 1994 and ASTM E2072.
2. Mounting: As recommended by manufacturer for material selected.

B. Sheet Aluminum Guidance Strips:

1. Complies with UL 1994 and ASTM E2072.
2. Mounting: As recommended by manufacturer for material selected.

C. High-Impact Plastic Guidance Strips:

1. Complies with ASTM E2072.
2. Width: 1 inch (26 mm).
3. Mounting: As recommended by manufacturer for material selected.

D. Polyester Tape Guidance Strips:

1. Complies with UL 1994 and ASTM E2072.
2. Width: 1/2 inch (12.5 mm).

E. Obstruction Strips: Black/luminous stripe marking on sheet aluminum.

1. Complies with UL 1994 and ASTM E2072.
2. Width: 1/2 inch (12.5 mm).
3. Mounting: As recommended by manufacturer for material selected.

F. Photoluminescent Stair Nosings: Factory fabricated aluminum extrusion with replaceable embedded photoluminescent and slip-resistant strip.

1. Complies with UL 1994 and ASTM E2072.
2. Finish: Anodized.
3. Mounting: Provide manufacturer approved field applied adhesive, factory applied adhesive and mechanical fasteners.

2.09 ACCESSORIES

A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.

B. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

D. Protect from damage until Substantial Completion; repair or replace damaged items.

END OF SECTION

ARCHITECTURAL ROOM SIGNAGE SCHEDULE

ARCH. ROOM NO.	ARCHITECTURAL ROOM NAME	OWNER'S ROOM NO.	OWNER'S ROOM NAME	BRAILLE	SYMBOL	SIGN TYPE
FIRST FLOOR - AREA "A"						
A101	VESTIBULE			X, X	-	J, L
A102	WAITING/RECEPTION			X, X	-	B, L(2)
A103	SUPPLIES			X	-	C
A104	ASSISTANT PRINCIPAL			X	-	A
A105	TOILET			X	H	E2
A106	TOILET			X	H	E2
A107	PASSAGE			X, X	-	B, L
A108	PRINCIPAL			X	-	A
A109	RECORDS STORAGE			X	-	C
A110	STUDENT SERVICES CONFERENCE			X	-	D
A111	ASSISTANT PRINCIPAL			X	-	A
A112	CLOSET			X	-	C
A113	CLOSET			X	-	C
A114	WORK ROOM			X	-	C
A115	PARENT RESOURCE CENTER			X	-	C
A116	CONFERENCE			X	-	D
A117	STAFF BREAK ROOM			X	-	B
A118	CORRIDOR			-	-	-
A118.1	EXAM			X	-	B
A118.2	EXAM			X	-	B
A119	CHAIR STORAGE			X	-	C
A120	BOY'S			X	M, H	E1
A121	JANITOR			X	-	C
A122	GIRL'S			X	W, H	E1
A123	CORRIDOR			-	-	-

ARCHITECTURAL ROOM SIGNAGE SCHEDULE

ARCH. ROOM NO.	ARCHITECTURAL ROOM NAME	OWNER'S ROOM NO.	OWNER'S ROOM NAME	BRAILLE	SYMBOL	SIGN TYPE
A124	MAIN LOBBY			X	-	L
A125	CORRIDOR			-	-	-
A126	MDF			X	-	C
A127	EQUIPMENT STORAGE			X	-	C
A128	MEDIA CENTER CLASSROOM			X, -	-	B(2), M(2)
A129	OFFICE			X	-	A
A130	MULTI-PURPOSE ART STUDIO			X, -	-	B, M
A131	ART STORAGE			X	-	C
A132	KILN			X	-	C
FIRST FLOOR - AREA "B"						
B101	DUAL PURPOSE ARTS ROOM			X, -	-	B, M
B102	MUSIC/ART STORAGE			X	-	C
B103	GENERAL MUSIC ROOM			X, -	-	B, M
B104	MUSIC STORAGE			X	-	C
B105	CORRIDOR			X	-	L
B106	CUSTODIAL OFFICE			X	-	C
B107	CUSTODIAL ST			X	-	C
B108	MECHANICAL/ELECTRICAL			X, X	-	C, L
B108.1	EMERGENCY ELECTRICAL					
B109	VESTIBULE			X, X	-	J, L
B110	RECEIVING/STORAGE			X, X	-	C(2), L
B111	DRY STORAGE			X	-	C
B112	LOCKERS			X	-	C
B113	TOILET			X	H	E2
B114	FOOD PREP			-	-	-

ARCHITECTURAL ROOM SIGNAGE SCHEDULE

ARCH. ROOM NO.	ARCHITECTURAL ROOM NAME	OWNER'S ROOM NO.	OWNER'S ROOM NAME	BRAILLE	SYMBOL	SIGN TYPE
B114.1	FREEZER AND COOLER			-	-	-
B115	SERVING			X	-	B
B116	OFFICE			X	-	C
B117	DISHWASHING			-	-	-
B118	PLATFORM			X, X	-	C, L
B119	INSTRUMENT STORAGE			X	-	C
B120	STAGE STORAGE			X	-	C
B121	TOILET			X	H	E2
B122	CAFETERIA			X, X, X	-	B(2), H(2), L(3)
B123	GYM STORAGE			X	-	C
B124	GYM STORAGE			X	-	C(2)
B125	TOILET			X	H	E2
B126	TOILET			X	H	E2
B127	TOILET			X	H	E2
B128	GYM STORAGE			X	-	C
B129	TOILET			X	H	E2
B130	P.E. OFFICE			X	-	C
B131	TOILET			X	H	E2
B132	GYMNASIUM			X, X, X	-	B, H, L(3)
B-S1	STAIR			X	S	F
FIRST FLOOR - AREA "C"						
C101	CORRIDOR			-	-	-
C102	NURSE RECEPTION			X	-	B
C103	COTS			-	-	-
C104	NOT USED			-	-	-

ARCHITECTURAL ROOM SIGNAGE SCHEDULE

ARCH. ROOM NO.	ARCHITECTURAL ROOM NAME	OWNER'S ROOM NO.	OWNER'S ROOM NAME	BRAILLE	SYMBOL	SIGN TYPE
C105	LAB			-	-	-
C106	TOILET			X	H	E2
C107	NOT USED			-	-	-
C108	NURSE OFFICE			X	-	B
C109	STORAGE			X	-	C
C110	IDF			X	-	C
C111	FACULTY TOILET			X	H	E2
C112	TOILET			X	H	E2
C113	CORRIDOR			-	-	-
C114	ESOL			X, -	-	B, M
C115	TOILET			X	H	E2
C116	STORAGE			X	-	C
C117	OVERFLOW CLASSROOM			X, -	-	B, M
C118	CORRIDOR			-	-	K
C119	TOILET			X	H	E2
C120	SPECIAL EDUCATION			X, -	-	B, M
C121	DE-ESCALATION ROOM			X	-	C
C122	ESOL			X, -	-	B, M
C123	FIRST GRADE CLASSROOM			X, -	-	B, M
C124	TOILET			X	H	E2
C125	TOILET			X	H	E2
C126	FIRST GRADE CLASSROOM			X, -	-	B, M
C127	COLLABORATIVE LEARNING			-	-	-
C128	TOILET			X	H	E2
C129	FIRST GRADE CLASSROOM			X, -	-	B, M
C130	CORRIDOR			-	-	-
C131	SGI			X, -	-	B, M

ARCHITECTURAL ROOM SIGNAGE SCHEDULE

ARCH. ROOM NO.	ARCHITECTURAL ROOM NAME	OWNER'S ROOM NO.	OWNER'S ROOM NAME	BRAILLE	SYMBOL	SIGN TYPE
C132	FIRST GRADE CLASSROOM			X, -	-	B, M
C133	TOILET			X	H	E2
C134	TOILET			X	H	E2
C135	FIRST GRADE CLASSROOM			X, -	-	B, M
C136	TECH STORAGE			X	-	C
C137	FACULTY TOILET			X	H	E2
C138	READING SUPPORT OFFICE			X	-	C
C139	ELECTRICAL			X	-	C
C-S1	STAIR			X, X, X	S, -, -	F, J, L(2)
C-S2	STAIR			X, X, X	S, -, -	F, J, L(2)
CE-1	ELEVATOR			X, X	-, F	C, G
FIRST FLOOR - AREA "D"						
D101	COLLABORATIVE LEARNING			-	-	-
D102	SECOND GRADE CLASSROOM			X, -	-	B, M
D103	TOILET			X	H	E2
D104	TOILET			X	H	E2
D105	SECOND GRADE CLASSROOM			X, -	-	B, M
D106	TOILET			X	H	E2
D107	SECOND GRADE CLASSROOM			X, -	-	B, M
D108	CORRIDOR			-	-	-
D109	SGI			X, -	-	B, M
D110	SECOND GRADE CLASSROOM			X, -	-	B, M
D111	TOILET			X	H	E2
D112	TOILET			X	H	E2
D113	SECOND GRADE CLASSROOM			X, -	-	B, M

ARCHITECTURAL ROOM SIGNAGE SCHEDULE

ARCH. ROOM NO.	ARCHITECTURAL ROOM NAME	OWNER'S ROOM NO.	OWNER'S ROOM NAME	BRAILLE	SYMBOL	SIGN TYPE
D-S1	STAIR			X, X, X	S, -, -	F, J, L(2)
FIRST FLOOR - AREA "E"						
E101	KINDERGARTEN			X, X, -	-	B, L(2), M
E102	TOILET			X	H	E2
E103	STORAGE			X	-	C
E104	KINDERGARTEN			X, X, -	-	B, L(2), M
E105	TOILET			X	H	E2
E106	STORAGE			X	-	C(2)
E107	KINDERGARTEN			X, X, -	-	B, L(2), M
E108	TOILET			X	H	E2
E109	KINDERGARTEN			X, X, -	-	B, L(2), M
E110	STORAGE			X	-	C
E111	TOILET			X	H	E2
E112	CORRIDOR			-	-	-
E113	PRE-K			X, X, -	-	B, L(2), M
E114	TOILET			X	H	E2
E115	STORAGE			X	-	C
E116	PRE-K			X, X, -	-	B, L(2), M
E117	TOILET			X	H	E2
E118	STORAGE			X	-	C(2)
E119	KINDERGARTEN			X, X, -	-	B, L(2), M
E120	TOILET			X	H	E2
E121	KINDERGARTEN			X, X, -	-	B, L(2), M
E122	TOILET			X	H	E2
E123	STORAGE			X	-	C

ARCHITECTURAL ROOM SIGNAGE SCHEDULE

ARCH. ROOM NO.	ARCHITECTURAL ROOM NAME	OWNER'S ROOM NO.	OWNER'S ROOM NAME	BRAILLE	SYMBOL	SIGN TYPE
E-S1	STAIR			X, X, X	S, -, -	F, J, L(2)

ARCHITECTURAL ROOM SIGNAGE SCHEDULE

ARCH. ROOM NO.	ARCHITECTURAL ROOM NAME	OWNER'S ROOM NO.	OWNER'S ROOM NAME	BRAILLE	SYMBOL	SIGN TYPE
SECOND FLOOR - AREA "C"						
C201	CORRIDOR			-	-	K
C202	STEAM			X, -	-	B, M
C203	FACULTY TOILET			X	H	E2
C204	GIRL'S			X	W, H	E1
C205	CORRIDOR			-	-	-
C206	ESOL			X, -	-	B, M
C207	TECH STORAGE			X	-	C
C208	SPECIAL EDUCATION			X, -	-	B, M
C209	ITINERATE OFFICE			X	-	A
C210	CORRIDOR			-	-	K
C211	ITINERATE OFFICE			X	-	A
C212	SPECIAL EDUCATION			X, -	-	B, M
C213	DE-ESCALATION ROOM			X	-	C
C214	ESOL			X, -	-	B, M
C215	FOURTH GRADE CLASSROOM			X, -	-	B, M
C216	FOURTH GRADE CLASSROOM			X, -	-	B, M
C217	COLLABORATIVE LEARNING			-	-	-
C218	FOURTH GRADE CLASSROOM			X, -	-	B, M
C219	CORRIDOR			-	-	-
C220	SGI			X, -	-	B, M
C221	FOURTH GRADE CLASSROOM			X, -	-	B, M
C222	FOURTH GRADE CLASSROOM			X, -	-	B, M
C223	BOY'S			X	M, H	E1
C224	FACULTY TOILET			X	H	E2
C225	ELECTRICAL			X	-	C

ARCHITECTURAL ROOM SIGNAGE SCHEDULE

ARCH. ROOM NO.	ARCHITECTURAL ROOM NAME	OWNER'S ROOM NO.	OWNER'S ROOM NAME	BRAILLE	SYMBOL	SIGN TYPE
C226	IDF			X	-	C
C227	SENSORY ROOM			X	-	C
C-S1	STAIR			X, X	S, -	F, L
C-S2	STAIR			X, X	S, -	F, L
CE-1	ELEVATOR			X, X	-, F	C, G
SECOND FLOOR - AREA "D"						
D201	COLLABORATIVE LEARNING			-	-	-
D202	FIFTH GRADE CLASSROOM			X, -	-	B, M
D203	FIFTH GRADE CLASSROOM			X, -	-	B, M
D204	FIFTH GRADE CLASSROOM			X, -	-	B, M
D205	CORRIDOR			-	-	-
D206	SGI			X, -	-	B, M
D207	FIFTH GRADE CLASSROOM			X, -	-	B, M
D208	FIFTH GRADE CLASSROOM			X, -	-	B, M
D-S1	STAIR			X, X	S, -	F, L
SECOND FLOOR - AREA "E"						
E201	CORRIDOR					
E202	STORAGE			X	-	C
E203	TOILET			X	H	E2
E204	THIRD GRADE CLASSROOM			X, -	-	B, M
E205	THIRD GRADE CLASSROOM			X, -	-	B, M
E206	TOILET			X	H	E2
E207	TOILET			X	H	E2
E208	THIRD GRADE CLASSROOM			X, -	-	B, M

ARCHITECTURAL ROOM SIGNAGE SCHEDULE

ARCH. ROOM NO.	ARCHITECTURAL ROOM NAME	OWNER'S ROOM NO.	OWNER'S ROOM NAME	BRAILLE	SYMBOL	SIGN TYPE
E209	COLLABORATIVE LEARNING			-	-	-
E210	THIRD GRADE CLASSROOM			X, -	-	B, M
E211	TOILET			X	H	E2
E212	TOILET			X	H	E2
E213	THIRD GRADE CLASSROOM			X, -	-	B, M
E214	OVERFLOW CLASSROOM			X, -	-	B, M
E215	TOILET			X	H	E2(2)
E216	JANITOR			X	-	C
E-S1	STAIR			X, X	S, -	F, L

LEGEND:	
X	PROVIDE BRAILLE ON SIGN
-	NOT REQUIRED
M	PROVIDE MALE PICTOGRAM
W	PROVIDE FEMALE PICTOGRAM
H	PROVIDE WHEELCHAIR PICTOGRAM
S	PROVIDE STAIR PICTOGRAM
F	PROVIDE STAIR/FIRE PICTOGRAM

SECTION 10 1500
VIDEO DISPLAY SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Panelized LED video display systems.

1.02 RELATED REQUIREMENTS

A. Section 05 5000 - Metal Fabrications: Support structure.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0533.16 - Boxes for Electrical Systems.

D. Section 26 4113 - Lightning Protection for Structures.

1.03 REFERENCE STANDARDS

A. ANSI/Infocomm 10 - Audiovisual Systems Performance Verification 2013.

B. UL 879 - Electric Sign Components Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data sheets on panelized LED display systems including recommendations for preparation, storage and handling, and installation.

C. Shop Drawings: Indicate cable routing, connections between equipment, anchor and support details, and adjacent construction.

D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

E. Project Record Documents: Provide quantities, type, and location for components, cabling and accessories.

F. System Setting Backup: Provide an electronic file of all system settings.

G. Security Items:

1. Provide one set of keys for each locked equipment enclosure.

2. Provide passwords to access control functions for hardware and software user interfaces.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Authorized Manufacturer Representative: System shall be configured and commissioned by an authorized manufacturer representative.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum [____] years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in compliance with manufacturer instructions.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide two-year manufacturer warranty for replacement.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Barco, Inc: www.barco.com/#sle.

B. Epson, www.epson.com

C. LG Electronics: www.lg.com/us/business/#sle.

D. SMART Technologies: www.smarttech.com

E. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PANELIZED LED VIDEO DISPLAY

A. Performance Requirements:

1. Comply with performance standards based on tests conducted in accordance with ANSI/Infocomm 10.
2. Provide products that are listed and labeled as complying with UL 879, where applicable.

B. System Type: [_____].

1. Pixel Pitch: 9.5 mm
2. Refresh Rate: [_____] [_____].
3. Horizontal Viewing Angle: [_____].
4. Vertical Viewing Angle: [_____].
5. Brightness: 1000 Nits [_____]
6. Mount Type: Free Standing/Self Supporting.
7. Location: Indoor and Outdoor.
8. Total Height: [_____] ft ([_____] m).

2.03 CONTROLS

A. Interface Unit:

1. With the following abilities; scale media, rotate media, adjust brightness, loop output, input selection and [_____].
2. Input source supports DVI, HDMI, PC, VGA, S-Video and [_____].
3. Output to Cat5.
4. Working Voltage: 120 VAC / 240 VAC at 60Hz.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrates and support structure is in place and properly prepared.

B. Verify that required power and data sources are provided.

C. Verify that space is available for centrally located components.

D. Notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Prepare substrates using the methods recommended by the manufacturer for achieving the best result under the project conditions.

B. Do not proceed with installation until support structure and substrates have been prepared using the methods recommended by the manufacturer and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions .

B. Install message center and signs level and plumb with fasteners reccommended by the manufacturer.

C. Custom Mounting: Coordinate with support structure specified in 05 5000 and indicated on drawings for mounting and support.

D. Record any necessary changes to the system design.

3.04 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Demonstrate proper operation and maintenance of equipment to Owner's designated representative.

D. Review service and support contacts.

3.05 PROTECTION

A. Protect installed products from subsequent construction operations.

END OF SECTION

SECTION 10 2113.13
METAL TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal toilet compartments.

B. Urinal and Vestibule screens.

C. Shower compartments.

1.02 RELATED REQUIREMENTS

A. Section 05 1200 - Structural Steel Framing: Concealed steel support members.

B. Section 05 5000 - Metal Fabrications: Concealed steel support members.

C. Section 10 2800 - Toilet, Bath, and Laundry Accessories.

1.03 REFERENCE STANDARDS

A. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling 2018.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2017.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall, floor and ceiling supports, door swings.

C. Product Data: Provide data on panel construction, hardware, and accessories.

D. Samples: Submit two samples of partition panels, illustrating panel finish, color, and sheen.

E. Manufacturer's Installation Instructions: Indicate special procedures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Toilet Compartments:

1. All American Metal Corp - AAMCO: www.allamericanmetal.com/#sle.
2. General Partitions Mfg. Corp: www.generalpartitions.com/#sle.
3. Global Steel Products Corp: www.globalpartitions.com/#sle.
4. Metpar Corp: www.metpar.com/#sle.
5. Substitutions: Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

2.03 COMPONENTS

A. Toilet Compartments: Powder coated steel, floor-mounted unbraced.

B. Doors, Panels, and Pilasters: Sheet steel faces, pressure bonded to sound deadening core, formed and closed edges; corners made with corner clips or mitered, welded, and ground smooth.

1. Panel Faces: 20 gage, 0.0359 inch (0.91 mm).
2. Door Faces: 22 gage, 0.0299 inch (0.76 mm).
3. Pilaster Faces: 20 gage, 0.0359 inch (0.91 mm).
4. Reinforcement: 12 gage, 0.1046 inch (2.66 mm).
5. Internal Reinforcement: Provide in areas of attached hardware and fittings. Mark locations of reinforcement for partition mounted washroom accessories.

C. Door and Panel Dimensions:

1. Door Width for Handicapped Use: 36 inch (915 mm) , out-swinging.
2. Height: 58 inch (1473 mm).

D. Pilasters: 1-1/4 inch (32 mm) thick, of sizes required to suit compartment width and spacing.

E. Urinal Screens: Wall mounted with two panel brackets, and floor-to-ceiling vertical upright consisting of pilaster anchored to floor and ceiling.

2.04 ACCESSORIES

A. Pilaster Shoes: Formed chromed steel with polished finish, 3 inch (175 mm) high, concealing floor fastenings.

1. Provide ceiling attachment using two adjustable hanging studs, attached to above-ceiling framing.

B. Head Rails: Hollow chrome-plated steel tube, 1 by 1-5/8 inch (25 by 41 mm) size, with anti-grip strips and cast socket wall brackets.

C. Brackets: Polished chrome-plated non-ferrous cast metal.

D. Attachments, Screws, and Bolts: Stainless steel , tamper proof type.

1. For attaching panels and pilasters to brackets: Through-bolts and nuts ; tamper proof.

E. Hardware: Polished chrome plated non-ferrous cast metal:

1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
2. Thumb turn or sliding door latch with exterior emergency access feature.
3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
4. Coat hook with rubber bumper; one per compartment, mounted on door.
5. Provide door pull for outswinging doors.

2.05 FINISHING

A. Powder Coated Steel Compartments: Clean, degrease, and neutralize. Follow immediately with a phosphatizing treatment, prime coat and two finish coats powder coat enamel.

B. Baked Enamel Steel Compartments: Clean, degrease, and neutralize. Follow immediately with a phosphatizing treatment, prime coat and two finish coats baked enamel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that field measurements are as indicated.

C. Verify correct spacing of and between plumbing fixtures.

D. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 3/8 to 1/2 inch (9 to 13 mm) space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

3.03 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch (6 mm).

B. Maximum Variation From Plumb: 1/8 inch (3 mm).

3.04 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch (5 mm) .

B. Adjust hinges to position doors in partial opening position when unlatched. Return out swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

SECTION 10 2123
CUBICLE CURTAINS AND TRACK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended overhead curtain track and guides.

B. Surface mounted overhead curtain track and guides.

C. Cubicle curtains.

D. Blackout curtains.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Owner-installed curtains.

B. Section 05 5000 - Metal Fabrications: Track supports above ceiling.

C. Section 06 1000 - Rough Carpentry: Blocking and supports for track.

D. Section 09 5100 - Acoustical Ceilings: Suspended ceiling system to support track.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2018b.

B. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films 2015.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for curtain fabric characteristics.

C. Samples: Submit two fabric samples,12 by 12 inches in size illustrating fabric color.

D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

E. Maintenance Data: Include recommended cleaning methods and materials and stain removal methods.

F. Maintenance Materials: Furnish the following for Owner 's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Curtains: Two of each type and size.
3. Extra Carriers: Ten.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept curtain materials on site and inspect for damage.

B. Store curtain materials on site and deliver to Owner for installation when requested.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cubicle Track and Curtains:

1. A. R. Nelson Co: www.arnelson.com/#sle.
2. C/S General Cubicl www.c-sgroup.com/cubicle-track-curtains/#sle.
3. Imperial Fastener Co., Inc.: www.imperialfastener.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 TRACKS AND TRACK COMPONENTS

A. Tracks: Extruded aluminum sections; one piece per track run.

1. Profile: Channel.
2. Mounting: Surface.
3. Track End Stop: To fit track section.
4. Finish on Exposed Surfaces: Clear anodized.

B. Curtain Carriers: Nylon rollers, size and type compatible with track; designed to eliminate bind when curtain is pulled; fitted to curtain to prevent accidental curtain removal.

C. Wand: Plastic, attached to lead carrier, for pull-to-close action.

D. Installation Accessories: Types required for specified mounting method and substrate conditions.

2.03 CURTAINS

A. Cubicle Curtains:

1. Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
2. Inherently flame resistant or flameproofed; capable of passing NFPA 701 test.
3. Material: Close weave polyester; anti-bacterial, self deodorizing, sanitized, and preshrunk.
4. Open Mesh Cloth: Open weave to permit air circulation; flameproof material, manufacturer's standard color.
5. Attachment of Curtain Fabric to Open Mesh Cloth: Manufacturer's standard sewn seam.

B. Blackout Curtains:

1. Inherently flame resistant or flameproofed; capable of passing NFPA 701 test.
2. Material: Polyester.
3. Valance: Same material and color as blackout curtain, adhered to face of track with hook and loop fastener strip, 12 inch (305 mm) drop.

C. Curtain Fabrication:

1. Width of curtain to be 10 percent wider than track length.
2. Include open mesh cloth at top 20 inches (508 mm) of curtain for room air circulation, attached to curtain as specified above.
3. Seams and Hems: Manufacturer's standard fabrication method for securely sewn and finished seams and hems.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and supports above ceiling are ready to receive work of this Section.

B. Verify that field measurements are as indicated.

3.02 INSTALLATION

A. Install curtain track to be secure, rigid, and true to ceiling line.

B. Secure track to ceiling system.

C. Install end cap and stop device.

D. Install curtains on carriers ensuring smooth operation.

E. Install blackout curtain valance on face of track.

END OF SECTION

SECTION 10 2219.63
DEMOUNTABLE GLASS PARTITIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal stud framing system.

B. Acoustic insulation.

C. Partition panels.

D. Frames for doors and glazed openings.

E. Doors and door hardware.

F. Glazing.

G. Wall base.

1.02 RELATED REQUIREMENTS

A. Section 08 1213 - Hollow Metal Frames.

B. Section 08 7100 - Door Hardware.

C. Section 09 9123 - Interior Painting: On-site painting.

1.03 REFERENCE STANDARDS

A. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members 2014, with Editorial Revision (2015).

B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.

C. ASTM C1036 - Standard Specification for Flat Glass 2016.

D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.

E. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass 2014.

F. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.

G. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).

H. ASTM E413 - Classification for Rating Sound Insulation 2016.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer; Avanti Systems USA: www.avantisystemsusa.com/#sle.

1. Phone: Toll Free (877) AVANTI-3; (877) 282-6843.

B. Substitutions: Section 01 6000 - Product Requirements.

2.02 DEMOUNTABLE GLASS PARTITIONS

A. Full-Height Glazed Partition System: Avanti Systems USA; Transverso Monoblock Modular Partition, double glazed, framed glass hinged doors, with integral blinds, hardware, and accessories.

B. Full-Height Glazed Partition System: Avanti Systems USA; Solare Double Glazed Frameless Partition System, straight, double-glazed, dry jointed, extruded aluminum top and bottom glazing channels, frameless glass pivot doors, with integral blinds, hardware, and accessories.

C. Double Glazed Stackable Glass Partitions: Avanti Systems USA; Elevare Stacking Double Glazed High Wall System, straight, double-glazed, dry jointed, pivot glass doors, hardware, and accessories.

D. Point Supported Glass Partitions: Avanti Systems USA; Elevare Point Support Single Glazed High Wall System, straight, single-glazed, dry jointed, pivot glass doors, hardware, and accessories.

E. Full-Height Vertical Mullion Glass Partitions: Avanti Systems USA; Elevare Mullion High Wall System, straight, single-glazed, dry jointed, pivot glass doors, hardware, and accessories.

F. Tension Supported Demountable Glass Partitions: Avanti Systems USA; Elevare Tension High Wall System, straight, single-glazed, dry jointed, pivot glass doors, hardware, and accessories.

G. Partition System: Demountable, non-progressive, capable of four direction lateral expansion with reusable components.

1. Module Width: As indicated on drawings.
2. Partition Height: As indicated on drawings.
3. Nominal Partition Thickness: 4 inches (100 mm).
4. Joints: Vertical, butt joint.
5. Utility Raceways: Provide access through posts, studs, cap channels, verticle support profiles, floor and base channels.

H. Performance Requirements:

1. Acoustic Attenuation: STC of 35 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
2. Fire Rating: Comply with applicable code.

2.03 MATERIALS

A. Glass:

1. Tempered Glass: Annealed flat glass meeting requirements of ASTM C1036, Type 1-Transparent Flat, Class 1-Clear, Quality Q3, and fully tempered in accordance with ASTM C1048, Kind FT.
   a. Thickness: 3/8 inch (9.5 mm).
   b. Prepare glazing panels for indicated fittings and hardware before tempering.
   c. Temper glass materials horizontally; visible tong marks or tong mark distortions are not permitted.
2. Laminated Glass: Fully tempered float glass laminated in accordance with ASTM C1172, with eased and polished edges.
   a. Plastic Interlayer: 0.060 inch (1.52 mm) thick, minimum.
   b. Thickness: 7/16 inch (11.1 mm).

B. Standard Gypsum Board: ASTM C1396/C1396M, 3/8 inch (10 mm) thick, maximum permissible length; ends square cut, square edges.

C. Fire Rated Gypsum Board: ASTM C1396/C1396M Type X, UL rated; 1/2 inch (13 mm) thick, maximum practical length; ends square cut, square edges.

D. Acoustic Insulation: ASTM C665, preformed mineral wool, friction fit type.

E. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

2.04 PARTITION COMPONENTS

A. Studs and Tracks: ASTM C645, sheet steel, 26 gage, 0.0179 inch (0.45 mm) minimum thickness, C shaped, with serrated faces.

B. Resilient Channels: Formed sheet steel, Z profile, [____] gage, [___] inch ([____] mm) thick.

C. Solid Panels: Gypsum board, standard, fire rated and [_____] laminated to [_____] core, panel thickness [____] inches ([____] mm); with facing of wall covering.

D. Base: Extruded aluminum.

2.05 DOOR AND WINDOW COMPONENTS

A. Frames: Extruded aluminum, manufacturers standard profile and thickness.

1. Finish: Integral finish.

2. Prepare and reinforce door frames for door hardware; provide resilient silencers color matched to frame color.

B. Sliding Glass Doors: Specified in Section 08 4126.

C. Pivoting Glass Doors: Specified in Section 08 4126.

D. Hollow Metal Doors and Panels: Specified in Section 08 1113.

E. Door Hardware: Manufacturer's standard; finish as selected by Architect.

1. Locksets, lock cylinder master keyed to building keying system.

2. Hinges: [_____].

F. Glazing: Manufacturer's standard.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building conditions are ready to receive partitions and that field measured dimensions are as indicated on shop drawings.

B. Verify that required utilities are available, in proper location, and ready for use.

3.02 INSTALLATION

A. Install partitions before placement of carpet.

B. Metal Stud Framing System:

1. Construct framing as indicated on drawings.

2. Install studs in accordance with partition system manufacturer's installation instructions.

3. Install double studs at jambs of door frames, glazed frames and [_____].

4. Coordinate installation of anchors, wall mounted reinforcement, electrical, and mechanical work placed within framing.

C. Acoustic Components:

1. Install acoustic sealant within partition system in accordance with sealant manufacturer's instructions and as required to achieve specified STC rating.
2. Install resilient channels on center on metal studs, and locate ends over framing members.
3. Install acoustic insulation in partitions tight within spaces, around openings, behind and around electrical and mechanical items, within or behind adjoining partitions, and tight to items passing through partitions.

D. Partition Panels:

1. Install panels in accordance with partition system manufacturer's instructions.

E. Frames: Install in accordance with partition system manufacturer's instructions; erect vertical members plumb, and horizontal members level.

F. Doors: Install in accordance with partition system manufacturer's instructions; hang to fit square within frame and to swing freely, without binding.

G. Door Hardware: Install in accordance with partition system manufacturer's instructions.

H. Glazing: Install in accordance with partition system manufacturer's instructions.

I. Wall Base: Install in accordance with partition system manufacturer's instructions.

J. Field Finishing:

1. Frames: Specified in Section 09 9123.
2. Doors: Specified in Section 09 9123.
3. Edge Trim: Specified in Section 09 9123.

3.03 TOLERANCES

A. Maximum Variation from True Plane of Partition Surfaces: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

B. Maximum Variation from Dimensioned Locations: 1/4 inch (6 mm) in any direction.

3.04 ADJUSTING

A. Adjust doors and frames to provide smooth door operation from open to closed position without gravity movement of door from any position.

3.05 PROTECTION

A. Do not permit subsequent construction activities to cause damage to appearance or operation of installed partition components until Date of Substantial Completion.

END OF SECTION

SECTION 10 4400
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire blankets.

C. Fire extinguisher cabinets.

D. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Field paint finish.

B. Section 21 1200 - Fire-Suppression Standpipes: Cabinet enclosure for extinguishers.

1.03 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).

B. FM (AG) - FM Approval Guide current edition.

C. NFPA 10 - Standard for Portable Fire Extinguishers 2017.

D. UL (DIR) - Online Certifications Directory Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide extinguisher operational features.

C. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.

D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.05 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers:

1. Ansul, a Tyco Business; [____]: www.ansul.com/#sle.
2. Nystrom, Inc; [_____]: www.nystrom.com/#sle.
3. Oval Brand Fire Products; Oval Dry Chemical Fire Extinguisher - Multipurpose ABC: www.ovalfireproducts.com/#sle.
4. Pyro-Chem, a Tyco Business; [_____]: www.pyrochem.com/#sle.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Fire Extinguisher Cabinets and Accessories:

1. Ansul, a Tyco Business: www.ansul.com/#sle.
2. Kidde, a unit of United Technologies Corp: www.kidde.com/#sle.
3. Nystrom, Inc; [_____]: www.nystrom.com/#sle.
4. Oval Brand Fire Products; Cabinets for Low Profile Extinguishers: www.ovalfireproducts.com/#sle.
5. Pyro-Chem, a Tyco Business: www.pyrochem.com/#sle.
6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
   1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.

B. Water Type Fire Extinguishers: Stainless steel tank, pressurized, with premixed antifreeze solution, including hose and nozzle.
   1. Class: 2-A type.
   2. Size and classification as scheduled.

C. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
   1. Class: A:B:C type.
   2. Size and classification as scheduled.
   3. Temperature range: Minus 40 degrees F (Minus 40 degrees C) to [___] degrees F ([___] degrees C).

D. Dry Chemical Type Fire Extinguishers: Stainless steel tank, with pressure gauge.
   1. Class: K type.
   2. Size and classification as scheduled.
   3. Temperature range: Minus 20 degrees F (Minus 29 degrees C) to 120 degrees F (49 degrees C).

2.03 FIRE EXTINGUISHER CABINETS

A. Fire Rating: Listed and labeled in accordance with ASTM E814 requirements for fire resistance rating of walls where being installed.

B. Cabinet Construction: Non-fire rated.

C. Fire Rated Cabinet Construction: One-hour fire rated.
   1. Steel; double wall or outer and inner boxes with 5/8 inch (15.9 mm) thick fire barrier material.

D. Cabinet Configuration: Semi-recessed type OR Recessed OR Surface Mounted
   1. Size to accommodate accessories.
   2. Exterior nominal dimensions of [____] inch ([____] mm) wide by [____] inch ([____] mm) high by [____] inch ([____] mm) deep.

E. Door: 0.036 inch (0.9 mm) metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinge.

F. Door Glazing: Float glass, clear, 1/8 inch (3 mm) thick, and set in resilient channel glazing gasket.

G. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

2.04 ACCESSORIES

A. Fire Blanket: Fire retardant treated wool; red, 62 by 84 inch (1575 by 2135 mm) size.

B. Extinguisher Brackets: Formed steel, chrome-plated.

C. Extinguisher Theft Alarm: Battery operated alarm, 10 second delay for disarming, activated by opening cabinet door.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings, [____] inches ([____] mm) from finished floor to inside bottom of cabinet.

C. Secure rigidly in place.

D. Place extinguishers and accessories in cabinets.

E. Position cabinet signage at As directed by Fire Marshall.

END OF SECTION

SECTION 10 5113
METAL LOCKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal lockers.

B. Locker benches.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete base construction.

B. Section 06 1000 - Rough Carpentry: Wood base construction.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2017.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's published data on locker construction, sizes and accessories.

C. Shop Drawings: Indicate locker plan layout, numbering plan, combination lock code, key codes and locker fillers, trim, base, sloping tops and accessories..

D. Samples: Submit two samples showing color and finish of metal locker material.

E. Shop Drawings: Include plans, elevations, sections, details, and attachments to other Work.

F. Show locker fillers, trim, base, sloping tops, and accessories. Include locker-numbering sequence.

G.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect locker finish and adjacent surfaces from damage.

PART 2 PRODUCTS

2.01 LOCKER APPLICATIONS

A. Student Lockers: Metal lockers, recessed mounted.

1. Configuration: Single tier.
2. Fittings: Size and configuration as indicated on drawings.
    a. Hooks: One single prong.
3. Ventilation: Louvers at top and bottom of door panel.
4. Locking: Built-in combination locks.

B. Athletic Lockers: Metal lockers, free-standing with matching closed base.

1. Configuration: Single tier.
2. Fittings: Size and configuration as indicated on drawings.
    a. Upper shelf.

b. Lock box.

c. Hooks: One single prong.

3. Ventilation: Perforated side panels and doors.

4. Locking: Built-in combination locks.

C. Locker Benches: Stationary type; bench top of laminated birch; painted steel pedestals.

1. Accessibility: Comply with ICC A117.1 and ADA Standards.

2.02 METAL LOCKERS

A. Accessibility: Comply with ICC A117.1 and ADA Standards.

B. Lockers: Factory assembled, made of formed sheet steel, ASTM A653/A653M SS Grade 33/230, with G60/Z180 coating, stretcher leveled; metal edges finished smooth without burrs; baked enamel finished inside and out.

1. Where ends or sides are exposed, provide flush panel closures.

2. Provide filler strips where indicated, securely attached to lockers.

3. Color: To be selected by Architect.

C. Locker Body: Formed and flanged; with steel stiffener ribs; electric spot welded.

1. Body and Shelves: 24 gage, 0.0239 inch (0.61 mm).

2. Base: 20 gage, 0.036 inch (0.9 mm).

3. Metal Base Height: 4 inch (100 mm).

D. Frames: Formed channel shape, welded and ground flush, welded to body, resilient gaskets and latching for quiet operation.

1. Door Frame: 16 gage, 0.0598 inch (1.52 mm), minimum.

E. Doors: Hollow double pan, sandwich construction, 1-3/16 inch (30 mm) thick; welded construction, channel reinforced top and bottom with intermediate stiffener ribs, grind and finish edges smooth.

1. Door Outer Face: 18 gage, 0.0478 inch (1.21 mm), minimum.

2. Door Inner Face: 20 gage, 0.0359 inch (0.91 mm), minimum.

3. Form recess for operating handle and locking device.

F. Hinges: Continuous piano hinge with powder coat finish to match locker color.

G. Trim: 20 gage, 0.0359 inch (0.91 mm).

H. Coat Hooks: Stainless steel or zinc-plated steel.

I. Number Plates: Provide oval shaped aluminum plates. Form numbers [____] inch ([____] mm) high of block font style with ADA designation, in contrasting color.

J. Locks: Locker manufacturer's standard type indicated above.

K. Built-In Lock Boxes: Same material as locker, manufacturer's standard size, with padlock hasps, for padlocks provided by Owner.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared bases are in correct position and configuration.

B. Verify bases and embedded anchors are properly sized.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Place and secure on prepared base.

C. Install lockers plumb and square.

D. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 pounds (445 N).

E. Bolt adjoining locker units together to provide rigid installation.

F. Install end panels, filler panels and sloped tops.

G. Install fittings if not factory installed.

H. Replace components that do not operate smoothly.

3.03 CLEANING

A. Clean locker interiors and exterior surfaces.

END OF SECTION

SECTION 10 5613
METAL STORAGE SHELVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Four post shelving.

B. Case type shelving.

C. Case type cabinets.

D. Cantilevered shelving.

E. Shelving accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Blocking and reinforcement in walls for anchoring shelving units.

B. Section 09 2116 - Gypsum Board Assemblies: Blocking and reinforcement in walls for anchoring shelving units.

C. Section 10 5626 - Mobile Storage Shelving: Installation of metal storage shelving on mobile carriages.

1.03 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Rated uniform shelf loads.
2. Details of shelving assemblies, including reinforcement.
3. Accessories.
4. Substrate preparation instructions and recommendations.
5. Storage and handling requirements and recommendations.
6. Installation methods.
7. Specimen warranty.
8. Maintenance methods.

C. Test Reports: Provide independent agency test reports documenting compliance with specified structural requirements.

1. In lieu of test reports, detailed drawings stamped and sealed by a Professional Engineer licensed in Maryland will be acceptable.

D. Shop Drawings: Indicate location, type, and layout of shelving, including lengths, heights, and aisle layout, and relationship to adjacent construction.

1. Indicate methods of achieving specified anchoring requirements.

E. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and finishes.

F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner 's name and registered with manufacturer.

G. Maintenance Materials: Furnish the following for Owner 's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

2. Extra Shelves: Two of each size with shelf brackets.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years of documented experience and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Inspect for dents, scratches, or other damage. Replace damaged units.

B. Store in manufacturer's unopened packaging until ready for installation.

C. Store under cover and elevated above grade.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide one year manufacturer warranty covering defects of manufacturing and workmanship and rust and corrosion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Four Post Shelving:

1. Hallowell: www.hallowell-list.com/#sle.

2. List Industries, Inc: www.listindustries.com/#sle.

3. Montel; SmartShelf: www.montel.com/#sle.

4. Penco Products, Inc: www.pencoproducts.com/#sle.

5. SpaceSaver Corporation: www.spacesaver.com/#sle.

6. Substitutions: See Section 01 6000 - Product Requirements.

B. Case Type Shelving and Cabinets:

1. List Industries, Inc; Case Shelving: www.listindustries.com/#sle.

2. Penco Products, Inc; [_____]: www.pencoproducts.com/#sle.

3. SpaceSaver Corporation; [_____]: www.spacesaver.com/#sle.

4. Tennsco Storage; Q-Line Shelving: www.tennsco.com/#sle.

5. Substitutions: See Section 01 6000 - Product Requirements.

C. Cantilevered Shelving:

1. Montel; Aetnastak: www.montel.com/#sle.

2. SpaceSaver Corporation: www.spacesaver.com/#sle.

3. Tennsco Storage; Estey Designer Series Library Shelving: www.tennsco.com/#sle.

4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SHELVING - GENERAL

A. See drawings for layout and sizes.

1. Clear Aisle Widths: [32] inches ([815] mm), minimum.

B. Seismic Design: Design for Seismic Zone 3, in accordance with ASCE 7, Section 9.

C. Anchors: Provide anchoring hardware to secure each shelving unit to floor and wall.

1. Provide hardware of type recommended by manufacturer for substrate.
2. See drawings for additional details of anchorage.

2.03 FOUR POST SHELVING

A. Four Post Shelving: Steel post-and-beam type with sway bracing, shelving brackets, shelving surfaces, and accessories as specified.

1. Unit Width: 24 inches (610 mm), center to center of posts.
2. Shelf Capacity: Uniform distributed load of 50 psf (2.4 kPa), minimum.
3. Shelf Deflection: 1/4 inch (6 mm) in 36 inches (914 mm), maximum, under specified uniform load.
4. Shelf Deflection: L/140, maximum, under specified uniform load.
5. Adjustability of Shelving: At intervals of 6 inches (150 mm) on center, minimum.
6. Shelves per Unit: As indicated on drawings.
7. Finish: Baked enamel, medium gloss.
8. Color: As selected by Architect from manufacturer’s standard range.
9. Provide single-face and double-face units where indicated.
10. Number of Units: As indicated on drawings.

B. Posts and Beams: Formed sheet members; perforations exposed on face of members are not acceptable.

1. Metal Thickness: 16 gage, 0.0598 inch (1.52 mm).
2. Post Shape: Tee intermediate posts, angle end posts forming corners.
3. Post Face Width: 2 inches (51 mm), maximum.
4. Connecting Hardware: Manufacturer's standard.

C. Bracing: Formed sheet members.

1. Back Sway Bracing: Either strap or panel; at back of each unit.
2. Side Sway Bracing: Either strap or panel; at each side of each unit.
3. See drawings for additional details of bracing.

D. Shelves: Formed sheet, finished on all surfaces , with slots for dividers.

1. Metal Thickness: 16 gage, 0.0598 inch (1.52 mm).
2. Shelf Connection to Posts: Manufacturer's standard.

2.04 CASE TYPE SHELVING AND CABINETS

A. Case Type Shelving: Steel, closed sides and backs, with shelving brackets, shelving surfaces, and accessories as specified.

1. Unit Width: 24 inches (610 mm), overall.
2. Shelf Capacity: Uniform distributed load of 50 psf (2.4 kPa), minimum.
3. Shelf Deflection: 1/4 inch (6 mm) in 36 inches (914 mm), maximum, under specified uniform load.
4. Adjustability of Shelving: At intervals of 6 inches (150 mm) on center.
5. Shelf Depth: 14-1/2 inches (610 mm), minimum.
6. Shelves per Unit: As indicated on drawings.
7. Unit Height: [__] inches ([__] mm), overall , maximum.
8. Finish: Baked enamel, medium gloss.
9. Color: As selected by Architect from manufacturer’s standard range.
10. Number of Units: As indicated on drawings.

B. Case Construction: Formed sheet metal comprising vertical support members and enclosure panels.
1. Shelf Support Members: 16 gage, 0.0598 inch (1.52 mm), minimum; manufacturer's standard profile.
2. Face Width of Exposed Vertical Supports: 2 inches (51 mm), maximum.
3. Panels: 24 gage, 0.0239 inch (0.61 mm), minimum.
4. Provide panels at intermediate divisions as well as ends and backs.
5. Connecting Hardware: Manufacturer's standard.
6. Post Bases: Flat steel foot plate , with manufacturer’s recommended adjustable leveling device.

C. Shelves: Formed sheet metal, finished on all surfaces with slots for dividers.
1. Thickness: 16 gage, 0.0598 inch (1.52 mm), minimum.
2. Shelf Edge Profile: Extending 3/4 inch (19 mm), maximum, below top surface of shelf.
3. Shelf Connection to Posts: Manufacturer's standard.

D. Cabinet Doors: Manufacturer's standard welded steel.
1. Style: Solid panel.
2. Hinges: Four-knuckle type.
3. Pulls: Recessed.
4. Locks: Manufacturer's standard keyed lock.

2.05 CANTILEVERED SHELVING

A. Cantilevered Shelving: Freestanding formed steel post frame with slots for cantilevered shelving brackets, sufficiently rigid not to require sway bracing, shelving brackets, shelving surfaces, and accessories as specified.
1. Unit Width: 24 inches (610 mm), center to center of posts.
2. Shelf Capacity: Uniform distributed load of 50 psf (2.4 kPa), minimum.
3. Shelf Deflection: 1/4 inch (6 mm) in 36 inches (914 mm), maximum, under specified uniform load.
4. Adjustability of Shelving: At intervals of 1 inches (25 mm) on center, minimum.
5. Shelf Depth: 14.5 inches (610 mm), minimum.
6. Finish: Baked enamel, medium gloss.

B. Frame: Formed steel members comprising posts, horizontal spreaders at top and bottom, and base brackets resisting overturning; frame configuration providing full face height and width available for adjustable shelves.
   1. Sheet Metal Thickness: 16 gage, 0.0598 inch (1.52 mm), minimum.
   2. Base Brackets Height from Floor: 9 inches (229 mm), maximum.
   3. Connecting Hardware: Manufacturer's standard.
   4. Provide manufacturer's standard adjustable leveling devices.

C. Shelf Brackets: Combination shelf support and bookend, formed steel; full depth of shelves and minimum 6 inches (150 mm) height above shelf surface; rounded outer edges and corners for safety.
   1. Thickness: 16 gage, 0.0598 inch (1.52 mm), minimum.
   2. Connection to Posts: Two hooks at top, safety lug at bottom.

D. Shelves: Formed steel, finished on all surfaces.
   1. Thickness: 18 gage, 0.0478 inch (1.21 mm), minimum.
   2. Bottom Shelf Edge Profile: 1 inch (25 mm) with integral kickplate.
   3. Upper Shelves Edge Profile: Extending 3/4 inch (19 mm), maximum, below top surface of shelf.
   4. Shelf Connections: Tab interlock with brackets ; positive bolt connection between shelf and bracket.

E. End Panels: Formed steel, finished on all surfaces.
   1. Thickness: 24 gage, 0.0239 inch (0.61 mm), minimum.
   2. Panel Faces: Flush, flat, without oil-canning.
   3. Provide end panels on all exposed ends of shelving runs.

2.06 ACCESSORIES

A. Kick Plates: Formed sheet metal; enclose open space between bottom shelf and floor on all front sides and open ends; finished to match.

B. Drawers: Formed steel, with mounting brackets and earthquake stops.
   1. Width: 5-5/8 inch (143 mm).
   2. Height: 4-5/8 inch (117 mm).
   3. Depth: Shelf depth.

C. Shelf Partitions: Steel, full height.
   1. Height: 3 inches (75 mm).

D. Sliding Shelf Supports: Plastic slider block with chrome plated wire, sliding along back rail.
   1. Height: 3 inches (75 mm).

E. Label Holders: Steel, attached to front face of shelf.
   1. Size: 2-1/4 by 3/4 inches (56 by 20 mm).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate is level and that clearances are as specified.

B. Verify that walls are suitable for shelving attachment.

C. Do not begin installation until substrates have been properly prepared.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Anchor and reinforce as specified, as indicated on drawings, and as recommended by manufacturer.

C. Install shelving with shelf surfaces level and vertical supports plumb; adjust feet and bases as required.

D. Out-Of-Square Tolerance - Four Post Shelving: Maximum of 1/8 inch (3 mm) difference in distance between bottom shelf and canopy top, measured along any post in any direction.

3.04 CLEANING

A. Clean shelving and surrounding area after installation.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 10 5617
WALL MOUNTED STANDARDS AND SHELVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shelf standards, brackets, and accessories.

B. Closet rods for mounting on brackets.

C. Shelves.

D. See drawings for locations and configurations.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wood blocking in walls for attachment of standards.

B. Section 06 2000 - Finish Carpentry: Wood shelves.

C. Section 09 2116 - Gypsum Board Assemblies: Blocking in metal stud walls for attachment of standards.

1.03 REFERENCE STANDARDS

A. NEMA LD 3 - High-Pressure Decorative Laminates 2005.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.

C. Maintenance Materials: Furnish the following for Owner 's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Brackets: Ten of each size of standard straight bracket.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products under cover and elevated above grade.

B. Store products in manufacturer's unopened packaging until ready for installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Shelf Standards and Brackets:

1. Knape & Vogt Manufacturing Company; 87™/187™ Series: www.knapeandvogt.com/#sle.
2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Super-Duty Shelf Standards and Brackets: Single-slotted channel standards for brackets adjustable in 1 inch (25 mm) increments along entire length of standard, drilled and countersunk for screws.

1. Load Capacity: Recommended by manufacturer for loading of 540 to 1,060 pounds (245 to 480 kg) per pair of standards.
2. Face Width: 5/8 inch (16 mm), single slotted.

3. Finish: Electroplated, chrome-look.
4. Brackets: 12 gage, 0.1046 inch (2.66 mm) sheet steel, reinforced, locking into slots with molded nylon cam lock lever; size to suit shelves; same finish as standards.
5. Bracket Quantity: Provide one bracket for each 12 inches (305 mm) of standard length.

B. Extra-Duty Shelf Standards and Brackets: Double-slotted channel standards for brackets adjustable in 1 inch (25 mm) increments along entire length of standard, drilled and countersunk for screws.

1. Load Capacity: Recommended by manufacturer for loading of 300 to 680 pounds (135 to 310 kg) per pair of standards.
2. Finish: Electroplated, chrome-look.
3. Brackets: Double tab type, locking into slots; size to suit shelves; same finish as standards.
4. Bracket Quantity: Provide one bracket for each 12 inches (305 mm) of standard length.

C. Heavy-Duty Shelf Standards and Brackets: Double-slotted channel standards for brackets adjustable in 1 inch (25 mm) increments along entire length of standard, drilled and countersunk for screws.

1. Load Capacity: Recommended by manufacturer for loading of 300 to 450 pounds (135 to 200 kg) per pair of standards.
2. Brackets: Double tab type, locking into slots; size to suit shelves; same finish as standards.
3. Provide snap-in cover strips to hide unused slots and screw holes.
4. Bracket Quantity: Provide one bracket for each 12 inches (305 mm) of standard length.

D. Heavy-Duty Shelf Standards and Brackets: Single-slotted channel standards for brackets adjustable in 1 inch (25 mm) increments along entire length of standard, drilled and countersunk for screws.

1. Load Capacity: Recommended by manufacturer for loading of 300 to 450 pounds (135 to 200 kg) per pair of standards.
2. Brackets: Double tab type, locking into slots; size to suit shelves; same finish as standards.
3. Bracket Quantity: Provide one bracket for each 12 inches (305 mm) of standard length.

E. Regular-Duty Shelf Standards and Brackets: Single-slotted channel standards for brackets adjustable in 1 inch (25 mm) increments along entire length of standard, drilled and countersunk for screws.

1. Load Capacity: Recommended by manufacturer for loading of 120 to 320 pounds (55 to 145 kg) per pair of standards.
2. Face Width: 5/8 inch (16 mm).
3. Material: 16 gage, 0.0598 inch (1.52 mm) sheet steel.
4. Finish: Electroplated, chrome-look.
5. Brackets: 16 gage, 0.0598 inch (1.52 mm) sheet steel, reinforced, locking into slots; size to suit shelves; same finish as standards unless not available.
6. Bracket Quantity: Provide one bracket for each 12 inches (305 mm) of standard length.

F. Shelf Standard Accessories:

1. At shelves indicated as sloping provide adjustable slant brackets.
2. Where cornices are indicated as part of shelving provide cornice brackets.
3. Where shelves are indicated to be fastened to brackets provide brackets with flanges for screwing into end of shelf, steel shelf rests, or flanged brackets; fasten with screws.

4. At glass shelves provide clear plastic shelf rests, front and back, with rubber cushions.

G. Closet Rods: Steel tubing for wall mounting in flange fittings.

1. Length: As required for application, up to 12 feet (3655 mm).
2. Provide mounting fittings to suit application.

H. Laminate Faced Shelves: Particleboard or medium density fiberboard covered with high pressure decorative laminate on both sides.

1. Edge Finish: Matching laminate, all four edges.
2. Substrate Thickness: 3/4 inch (19 mm), nominal.
3. Laminate: NEMA LD 3 Type HGL.
4. Shelf Quantity: Provide one shelf for each 12 inches (305 mm) of length of standard, per pair of standards, unless otherwise indicated.

I. Wood Shelves: Hardwood veneer plywood with matching solid wood glued edges on all four edges.

1. Species and Cut: [_____].
2. Thickness: 3/4 inch (19 mm), nominal.
3. Length: 36 inches (915 mm).
4. Finish: Polyurethane varnish.

J. Glass Shelves: Fully tempered float glass, clear, 1/4 inch (6 mm) thick.

1. Length: 36 inches (915 mm).

K. Fasteners: Screws as recommended by manufacturer for intended application or as otherwise required by project conditions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Mount standards to solid backing capable of supporting intended loads.

C. Install brackets, shelving, and accessories.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 10 5723
CLOSET AND UTILITY SHELVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall mounted wire closet shelving.

B. Laminated shelves associated with wire shelving.

C. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Blocking in walls for attachment of shelving.

B. Section 09 2116 - Gypsum Board Assemblies: Blocking in metal stud walls for attachment of standards.

1.03 REFERENCE STANDARDS

A. NEMA LD 3 - High-Pressure Decorative Laminates 2005.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, with installation instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store products under cover and elevated above grade.

C. Store flat to prevent warpage and bending.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wire Storage Shelving:

1. ClosetMaid Corporation : www.closetmaid.com/#sle.
2. RubberMaid Closet and Organization Products : www.rubbermaidcloset.com/#sle.
3. [_____].
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SHELVING APPLICATIONS

A. Shelf Depth: 12 inches (305 mm), unless otherwise indicated.

B. Storage Closets:

1. Wall-to-wall storage shelves, close-mesh cross wire spacing, stacked at 13 inch (330 mm) vertically, not less than 12 inch (305 mm) deep.

2.03 MATERIALS

A. Wire Shelving: Factory-assembled coated wire mesh shelf assemblies for wall-mounting, with all components and connections required to produce a rigid structure that is free of buckling and warping.

1. Construction: Cold-drawn steel wire with average tensile strength of 100,000 psi (690 MPa) resistance welded into uniform mesh units, square, rigid, flat, and free of dents or other distortions, with wires trimmed smooth.

2. Coating: PVC or epoxy, applied after fabrication, covering all surfaces.
3. Standard Mesh Shelves: Cross deck wires spaced at 1 inch (25.4 mm).
4. Close-Mesh Shelves: Cross deck wires spaced at 1/2 inch (12.7 mm).
5. Shelf and Rod Units: Integral hanging rod at front edge of shelf.

B. Laminated Shelves: Particleboard with thermal-fused melamine surface on top and bottom.
1. Edge Finish: Hot-melt PVC edge banding, matching color.
2. Substrate Thickness: 3/4 inch (19 mm), nominal.

C. Mounting Hardware: Provide manufacturer's standard mounting hardware; include support braces, wall brackets, back clips, end clips, poles, and other accessories as required for complete and secure installation; factory finished to match shelving.

D. Fasteners: As recommended by manufacturer for mounting substrates.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions, with shelf surfaces level.

B. Cap exposed ends of cut wires.

C. Install back clips, end clips at side walls, and support braces at open ends. Install intermediate support braces as recommended by manufacturer.

D. Mounting Heights:
1. Single Hanging Rod Units: Install shelf at 68 inches (1727 mm) above floor.
2. Double Hanging Rod Units: Install shelves at 42 inches (1067 mm) and 84 inches (2134 mm) above floor.
3. Other Shelves: See drawings.

3.03 CLEANING

A. Clean soiled surfaces after installation.

3.04 PROTECTION

A. Protect installed work from damage.

B. Touch-up, repair, or replace damaged products before Substantial Completion in a manner that eliminates evidence of replacement.

END OF SECTION

SECTION 10 7113.43
FIXED SUN SCREENS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Modular, shop fabricated, extruded aluminum sun screens to be mounted on structure provided by others.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Mounting substrates.

B. Section 04 2000 - Unit Masonry: Mounting substrates.

C. Section 05 1200 - Structural Steel Framing: Mounting substrates.

D. Section 07 4213 - Metal Wall Panels: Mounting substrates.

E. Section 08 4313 - Aluminum-Framed Storefronts: Mounting substrates.

F. Section 08 4413 - Glazed Aluminum Curtain Walls: Mounting substrates.

G. Section 08 5113 - Aluminum Windows: Mounting substrates.

H. Section 10 7113 - Exterior Sun Control Devices: Operable sun control devices.

1.03 REFERENCE STANDARDS

A. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2014 (Editorial 2017).

B. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process 2010 (Reapproved 2015).

C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.

D. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.

E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2014.

F. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2013.

G. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs 2017.

1.04 SUBMITTALS

A. Shop Drawings: Prior to commencement of fabrication, submit detailed shop drawings, showing all profiles, sections of all components, finishes, fastening details, and manufacturer's technical and descriptive data. Include field dimensions of openings and elevations on shop drawings.

B. Design Data: Submit comprehensive structural analysis of design for the specified loads. Stamp and sign calculations by professional engineer.

C. Samples: 10 inches (254 mm) by 10 inches (254 mm) minimum illustrating design, workmanship and finish color.

D. Sample of Louver: For review of shape only.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Perform structural design under direct supervision of a Professional Engineer experienced in design of this type of work licensed in Maryland.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with no less than five years of documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section.

1. With minimum five years of documented experience.

2. Approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site ready for erection.

B. Package using methods that prevent damage during shipping and storage on site.

C. Store materials under cover and elevated above grade.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Sun Screens: Correct defective work within a one year period after Date of Substantial Completion.

C. Finish Warranty: Provide manufacturer's [_____] warranty on factory finish against cracking, peeling, and blistering.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fixed Sun Screens:

1. Same manufacturer as curtain wall to which sun screens are to be attached.

2. Architectural Grilles & Sunshades, Inc; [_____]: www.agsshade.com/#sle.

3. DAMS Incorporated; RA Series: www.damsinc.com/#sle.

4. Industrial Louvers, Inc; [_____]: www.industriallouvers.com/#sle.

5. Metalwerks; Sunshades: www.metalwerksusa.com/#sle.

6. [_____].

7. [_____].

8. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SUN SCREENS

A. Sun Screens: Shop fabricated, shop finished, extruded aluminum outriggers, louvers, and fascia, free of defects impairing strength, durability or appearance.

1. Configuration: As indicated on drawings.

2. Louver Type: Bar.

3. Outrigger Shape: Straight.

4. Design Criteria: Design and fabricate to resist the following loads without failure, damage, or permanent deflection:

a. Wind: [___] psf ([___] kPa) positive, [___] psf ([___] kPa) negative; minimum

b. Snow: [___] psf ([___] kPa); minimum.

c. Live: [___] psf ([___] kPa); minimum.

d. Thermal Movement: Plus/minus 1/8 inch (3.175 mm), maximum.

5. Sizes: As indicated on drawings.

6. Exposed Aluminum Finish: Match Aluminum-Framed Storefront framing, refer to section for finish information.

7. Provide a complete system ready for erection at project site.

2.03 MATERIALS

A. Aluminum Extrusions: ASTM B209 (ASTM B209M) or ASTM B221 (ASTM B221M).

B. Aluminum Coated Steel Sheet: ASTM A792/A792M.

C. Concealed Structural Supports: Aluminum, or steel coated for corrosion resistance and dissimilar metal isolation.

D. Fasteners: ASTM F593 stainless steel or ASTM A307 carbon steel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and site area for conditions that might prevent satisfactory installation.

B. Verify that dimensions of supporting structure are within plus/minus 1/8 inch (3.175 mm) of dimensions indicated on shop drawings.

C. Verify that all adjacent painting, roofing, masonry work, and other work that might damage sun screen finish has been completed prior to installation of sun screens.

D. Do not install until after all adjacent painting, roofing and masonry have been completed.

E. Do not proceed with installation until all conditions are satisfactory.

3.02 INSTALLATION

A. Install in accordance with manufacturer's installation instructions.

B. Set units level, plumb, with uniform joints, and aligned with building elements.

C. Separate dissimilar metals using concealed bituminous paint or non-absorbent gasket.

D. Anchor units to structure as indicated on drawings.

E. Do not cut or trim aluminum members without approval of manufacturer; do not install damaged members.

F. Touch-up damaged finish coating using material provided by manufacturer to match original coating.

3.03 TOLERANCES

A. Maximum Variation from Level: Plus/Minus 1/8 inch (3.175 mm).

3.04 CLEANING

A. Clean exterior surfaces units of dust and debris; follow manufacturer's cleaning instructions for the finish used.

3.05 PROTECTION

A. Protect units after installation to prevent damage due to other work until Date of Substantial Completion.

END OF SECTION

SECTION 10 7113
EXTERIOR SUN CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Operable sun control devices for exterior applications:

1. Sun control louvers.
2. Retractable exterior blinds.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Mounting substrates.

B. Section 04 2000 - Unit Masonry: Mounting substrates.

C. Section 05 1200 - Structural Steel Framing: Mounting substrates.

D. Section 07 4213 - Metal Wall Panels: Mounting substrates.

E. Section 08 4313 - Aluminum-Framed Storefronts: Mounting substrates.

F. Section 08 4413 - Glazed Aluminum Curtain Walls: Mounting substrates.

G. Section 08 5113 - Aluminum Windows: Mounting substrates.

H. Section 10 7113.43 - Fixed Sun Screens: Non-operable exterior sun screens.

1.03 REFERENCE STANDARDS

A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.

B. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.

1. Motorized Sun Control Devices: Include power requirements and standard wiring diagrams.

C. Shop Drawings: Prior to commencement of fabrication, submit detailed shop drawings, showing all profiles, sections of all components, finishes, fastening details, and manufacturer's technical and descriptive data. Include field dimensions of openings and elevations on shop drawings.

1. Motorized Sun Control Devices: Include schematic system riser diagram indicating component interconnections, detailed sequence of operations describing system functions, and requirements for interface with other systems.

D. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Project Record Documents: Record actual locations of control systems and show interconnecting wiring.

F. Specimen Warranty: Furnish a copy of manufacturer's standard warranty.

1.05 QUALITY ASSURANCE

A. Motorized Sun Control Devices: Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with no less than five years of documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section.

1. With minimum five years of documented experience.

2. Approved by manufacturer.

1.06 MOCK-UP

A. Mock-Up: Provide [___] feet wide by [___] feet high, minimum ([___] m wide by [___] m high, minimum) mock-up of sun control device assembly at project site.

1. Obtain Architect's approval before proceeding with installation of remaining work.

2. Full-sized mock-up may become part of the final installation.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site ready for erection.

B. Package using methods that prevent damage during shipping and storage on site.

C. Store materials under cover and elevated above grade.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Sun Control Devices: Correct defective work within a five year period after Date of Substantial Completion.

C. Finish Warranty: Provide manufacturer's [_____] warranty on factory finish against cracking, peeling, and blistering.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Sun Control Louvers:

1. Basis of Design: Draper, Inc as indicated under product description below; www.draperinc.com/#sle.

2. Other Acceptable Manufacturers:

a. Skyshield International, Inc: www.skyshieldlouverblinds.com/#sle.

b. [_____] .

c. [_____].

3. Substitutions: See Section 01 6000 - Product Requirements.

B. Retractable Exterior Blinds:

1. Basis of Design: Draper, Inc as indicated under product description below; www.draperinc.com/#sle.

2. Other Acceptable Manufacturers:

a. Construction Specialties, Inc: www.c-sgroup.com/#sle.

3. Substitutions: See Section 01 6000 - Product Requirements.

C. Source Limitations: Furnish sun control devices and associated controls produced by a single manufacturer and obtained from a single supplier.

2.02 SUN CONTROL LOUVERS

A. Description: Non-retractable, factory-finished rack arm assembly with operable louver tilt function; size and configuration as indicated on drawings.

B. General Requirements:

1. Rack Arm: Extruded aluminum, factory assembled with pivot arms and associated hardware for operation of louvers.

C. Sun Control Louver - Basis of Design: Draper, Inc; FlexLouver Rack Arm System; www.draperinc.com/#sle.

1. Rack Arm Style: Standard profile; 1-3/8 by 7/8 inch (35 by 20 mm).
2. Louvers: Aluminum, perforated rolled edge; 3-1/8 inches (80 mm) wide nominal; Model 80R.
    a. Perforations: To be selected.
3. Mounting Brackets: Adjustable, with threaded stainless steel rod attached to rack arm and to aluminum plates.
4. Frames: Aluminum, fixed.
    a. Light Penetration Prevention: Provide baffles and black nylon brushes between louvers and frame and black nylon brushes between frame and structure.
5. Operator: Manual, with gearbox operating mechanism.
    a. Manual Gearbox Operating Mechanism: Operated by crank handle.

2.03 RETRACTABLE EXTERIOR BLINDS

A. Description: Horizontal slats hung from full-width headrail with full-width bottom rail and side guides or wires for slat stability; motorized operation; size and configuration as indicated on drawings.

B. General Requirements:

1. Motors: Size and configuration as recommended by manufacturer for the type, size, and arrangement of sun control devices to be operated; integrated into device operating components and concealed from view; fully compatible with controls to be installed.

C. Retractable Exterior Blinds - Basis of Design: Draper, Inc; Venetian Blinds by Warema; www.draperinc.com/#sle.

1. Headrail: Extruded aluminum; 2-3/8 inch (60mm) deep by 2-1/8 inch (54mm) tall, suitable for blinds with drop of up to 23 feet 7 inches (719 cm). Headrail to be open on the underside.
2. Headrail Box: Custom fabricated sheet aluminum box to protect blinds in raised position. Size as required to cover stack of retracted blinds and with depth 2-3/8 inch (60 mm) greater than slat width.
3. Bottom Rail: Extruded aluminum with plastic end caps; 2 inch by 7/8 inch (50 mm by 20 mm).
4. Slats: Aluminum; 0.012 inch (0.30 mm) thickness, nominal.
5. Lifting/Ladder Tape: Tear resistant terylene yarn configured to support, tilt, and lift slats.
6. Side Guides:
7. Mounting: Direct-mounted utilizing keyhole slots in headrail.
8. Motor: Tubular, 110 VAC .

2.04 PERFORMANCE REQUIREMENTS

A. Design and size components to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of window wall.

2.05 MOTOR CONTROLS

A. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the control intent indicated.

B. Provide all components and connections necessary to interface with other systems as indicated.

C. Control Requirements:

1. Sun Control Louvers: Control tilt function.
2. Retractable Exterior Blinds: Control raise/lower and tilt functions.
3. Provide for alignment of positions for sun control devices operated by separate motors.
4. Provide capability of reassigning sun control devices to inputs and groups without rewiring.
5. User Control: Utilize wall controls for individual and group control of sun control devices as indicated.
6. Automatic Light Level Control: Utilize photo sensors to automatically adjust position of sun control devices according to available light.
7. Automatic Timer Control: Utilize programmable timer to automatically adjust position of sun control devices according to selected schedule.
8. Automatic Wind Control: Utilize anemometer to automatically adjust position of sun control devices in response to wind speeds in excess of maximum allowable values.
9. Automatic Solar-Tracking Controls:
    a. Description: Utilize calculated position of sun based on building location, date, and time to automatically adjust position of sun control devices.
    b. Manual Override Capability: Allow temporary override of designated sun control devices using wall controls and computer interface.
    c. Automatic Override Capability: Utilize photo sensors to detect cloudy conditions and automatically adjust position of sun control devices to maximize view and available daylight.
10. Interface with building automation system as specified in Section [_____].

2.06 MATERIALS

A. Aluminum Extrusions: ASTM B221 (ASTM B221M).

B. Sheet Aluminum: ASTM B209 (ASTM B209M).

2.07 FINISHES

A. High Performance Organic Coatings: AAMA 2604; multiple coats, thermally cured fluoropolymer system.

B. Concealed aluminum components, mill finish.

C. Factory Finishes: Uniform, smooth and without blemishes.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and site area for conditions that might prevent satisfactory installation.

B. Do not install until after adjacent painting, roofing and masonry work has been completed.

C. Do not proceed with installation until related conditions are satisfactory.

3.02 INSTALLATION

A. Install in accordance with manufacturer's installation instructions.

B. Set units level, plumb, with uniform joints, and aligned with building elements.

C. Separate dissimilar metals using concealed bituminous paint or non-absorbent gasket.

D. Anchor units to structure as indicated on drawings.

3.03 TOLERANCES

A. Maximum Variation from Level: Plus/minus 1/8 inch (3.175 mm).

3.04 ADJUSTING

A. Motorized Sun Control Devices:

1. Set limit switches for uniform range of motion according to project requirements.

2. Program control system parameters according to requirements of Owner.

3.05 CLEANING

A. Clean exterior surfaces units of dust and debris; follow manufacturer's cleaning instructions for the finish used.

B. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

3.06 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate operation and maintenance of exterior sun control devices to Owner's personnel.

D. Training: Train Owner's personnel on operation and maintenance of system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

3.07 PROTECTION

A. Protect units after installation to prevent damage due to other work until Date of Substantial Completion.

END OF SECTION

SECTION 10 7316.13
METAL CANOPIES

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete footings.

B. Section 07 7123 - Manufactured Gutters and Downspouts.

1.02 REFERENCE STANDARDS

A. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges 2016.

B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.

C. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2014 (Editorial 2017).

D. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel 2015.

E. ASTM A924/A924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process 2017a.

F. ASTM A992/A992M - Standard Specification for Structural Steel Shapes 2011 (Reapproved 2015).

G. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink) 2014a.

H. ASTM E2950 - Standard Specification for Metal Canopy Systems 2014.

I. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs 2017.

J. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions 2015a.

K. AWS D1.1/D1.1M - Structural Welding Code - Steel 2015, with Errata (2016).

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit product data sheets, including material descriptions and finishes, and preparation instructions and recommendations.

C. Shop Drawings: Prior to commencement of fabrication, submit detailed shop drawings, showing profiles, sections of components, finishes, and fastening details.

D. Design Data: Submit comprehensive structural analysis of design for the specified loads. Stamp and sign calculations by professional engineer.

E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in Maryland.

1. Comply with applicable code for submission of design calculations as required for acquiring permits.

B. Perform work in accordance with AISC 303.

C. Erector Qualifications: Company specializing in performing the work of this section.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site ready for erection.

B. Package using methods that prevent damage during shipping and storage on site.

C. Store materials under cover and elevated above grade.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Metal Canopies: Correct defective work within a two year period after Date of Substantial Completion.

C. Finish Warranty: Provide manufacturer's one year warranty on factory finish against cracking, peeling, and blistering.

PART 2 PRODUCTS

2.01 METAL CANOPIES

A. Shop Fabricated Metal Canopy Type: [_____] .

1. Pre-engineered system complying with ASTM E2950.

2. Design and fabricate metal canopy system to resist wind, snow, live and seismic loads without failure, damage, or permanent deflection in accordance with ASCE 7:

   a. Loads: As indicated on drawings.

3. Thermal Movement: Design canopy system to accommodate thermal movement caused by ambient temperature range of 120 degrees F (49 degrees C) and surface temperature range of 180 degrees F (82 degrees C) without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects on assembly components.

2.02 COMPONENTS

A. Structural Steel Framing:

1. Columns: ASTM A500/A500M, Grade B, round or rectangular tubing, sized to suit project design load requirements.

2. Base and Top Plates: ASTM A36/A36M, with pre-drilled bolt holes.

3. Beams: Wide flange, ASTM A572/A572M Grade 50.

4. Other Structural Steel Members: ASTM A36/A36M.

B. Covering:

1. Sheet Metal Decking: Interlocking metal panels.

   a. Panel Size: 16 inches wide by 3 inches deep (406 mm wide by 76 mm deep); 20 gauge, 0.0359 inch (0.91 mm) thickness.

   b. Provide canopy manufacturer's standard clip type fasteners for attaching covering to structural beams.

C. Fascia: Manufacturer's standard flat profile.

D. Anchor Bolts: ASTM A307 or ASTM A572/A572M, formed with bent shank, assembled with template for casting into concrete.

1. Minimum exposed thread of 7 inches (178 mm) above footing and 23 inch (584 mm) minimum embedment.
2. Provide nuts and washers as required for column leveling and plumbing.

E. Concrete Footings: Refer to Section 03 3000 for additional requirements.

F. Exposed Gutters and Downspouts: Galvanized steel with baked enamel finish, color to match canopy covering, manufacturer's recommended size for canopy specified.

1. Refer to Section 07 7123 for additional requirements.

2.03 SHOP FABRICATION

A. Provide a complete system ready for erection at project site.

B. Shop fabricate to the greatest extent possible; disassemble if necessary for shipping.

C. Perform welding in accordance with AWS D1.1/D1.1M.

D. Fabricate connections for bolt, nut, and washer connectors.

2.04 FINISHES

A. Structural Steel Framing:

1. Shop Primer: Rust-inhibitive red oxide.

B. Steel Decking: Polyester baked enamel finish; color as selected from manufacturer's standard range.

C. Fascia: Polyester baked enamel finish; color as selected from manufacturer's standard range.

2.05 ACCESSORIES

A. Structural Bolts: ASTM F3125/F3125M, Grade A325, minimum 3/4 inch (19 mm) diameter.

B. Trim, Closure Pieces and Flashings: Same material, thickness and finish as sheet metal decking; factory-fabricated to required profiles.

1. Exposed Fasteners: Not permitted.

C. Grout: ASTM C1107/C1107M; non-shrinking; premixed compound consisting of non-metallic aggregate, cement, water-reducing and plasticizing agents.

D. Fasteners, Non-Structural: ASTM F593 stainless steel or ASTM A307 carbon steel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and site area for conditions that might prevent satisfactory installation.

B. Verify that foundation, electrical utilities, and placed anchors are in correct position.

C. Do not proceed with installation until all conditions are satisfactory.

3.02 INSTALLATION - FRAMING

A. Erect framing in accordance with AISC 303.

B. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation.

C. Set column base plates with non-shrink grout to achieve full plate bearing.

D. Fasten columns to anchor bolts.

E. Do not field cut or alter structural members without approval.

F. After erection, prime welds, abrasions, and surfaces not shop primed.

3.03 INSTALLATION - CANOPY COVERING

A. Install in accordance with manufacturer's instructions.

B. Fasten metal decking to steel support members, aligned level and plumb.

C. Install fascia panels, trim and flashing.

D. Separate dissimilar metals using concealed bituminous paint.

E. Touch-up damaged finish coating using material provided by manufacturer to match original coating.

3.04 TOLERANCES

A. Maximum Variation from Level: Plus/Minus 1/8 inch (3.175 mm).

3.05 CLEANING

A. Clean surfaces of dust and debris; follow manufacturer's cleaning instructions for the finish used.

END OF SECTION

SECTION 10 7500
FLAGPOLES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes a ground-set flagpole made from aluminum.

1.02 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide flagpole assemblies, including anchorages and supports, capable of withstanding the effects of wind loads, determined according to NAAMM FP 1001, "Guide Specifications for Design of Metal Flagpoles" unless governing jurisdiction provides other requirements.

1. Base flagpole design on nylon or cotton flags of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.
2. Basic Wind Speed: 100 mph; 3-second gust speed at 33 feet aboveground.

1.03 SUBMITTALS

A. Product Data: For type of flagpole required.

B. Shop Drawings: Include elevations and details showing general arrangement, jointing, fittings and accessories, grounding, and anchoring and supporting systems.

1. Include details of foundation system for ground-set flagpole.

C. Structural Calculations: Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Qualification Data: For professional engineer.

1.04 QUALITY ASSURANCE

A. Source Limitations:

1. Obtain flagpole as a complete unit, including fittings, accessories, bases, and anchorage devices, from a single manufacturer.
2. Obtain flagpole through one source from a single manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Spiral wrap flagpole with heavy paper and enclose in a hard fiber tube or other protective container.

1.06 COORDINATION

A. Provide anchoring devices to precast concrete manufacturer for casting.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Flagpole; a Kearney-National Inc. Company.
2. Baartol Company Inc. (The)
3. Concord Industries, Inc.
4. Ewing International.
5. Lingo Inc.; Acme Flagpole Division.

6. Michigan Flagpole Inc.
7. Morgan-Francis Div.; Original Tractor Cab Co., Inc.
8. Pole-Tech Company Inc.

2.02 FLAGPOLE

A. Flagpole Construction, General: Construct flagpole in one piece if possible. If more than one piece is necessary, comply with the following:
   1. Fabricate shop and field joints without using fasteners, screw collars, or lead calking.
   2. For tapered flagpoles, provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.

B. Exposed Height: 30 feet.

C. Aluminum Flagpole:
   1. Provide cone-tapered flagpole fabricated from seamless extruded tubing complying with ASTM B 241, Alloy 6063, with a minimum wall thickness of 3/16 inch.
   2. Heat treat after fabrication to comply with ASTM B 597, Temper T6.

D. Foundation Tube: Galvanized corrugated-steel foundation tube, 0.064-inch minimum nominal wall thickness. Provide with 3/16-inch steel bottom plate and support plate; 3/4-inch diameter, steel ground spike; and steel centering wedges all welded together. Galvanize steel parts, including foundation tube, after assembly. Provide loose hardwood wedges at top of foundation tube for plumbing pole.
   1. Provide flashing collar of same material and finish as flagpole.
   2. Provide steel ground protectors extending 12 inches aboveground and 6 inches belowground for steel flagpoles where flashing collars are not provided.

2.03 FITTINGS

A. Finial Ball: Manufacturer's standard flush-seam ball, sized as indicated or, if not indicated, to match flagpole-butt diameter.
   1. 3-inch spun aluminum, finished to match flagpole.

B. Internal Halyard, Cam Cleat System: 5/16-inch- diameter, braided polypropylene halyard; cam cleat; and concealed revolving truck assembly with plastic-coated counterweight and sling. Provide flush access door secured with cylinder lock. Finish truck assembly to match flagpole.
   1. Halyard Flag Snaps: Provide two chromium-plated bronze swivel snap hooks per halyard.
   2. Provide with neoprene or vinyl covers.

2.04 MISCELLANEOUS MATERIALS

A. Concrete: Comply with requirements in Division 3 Section "Building Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi.

B. Sand: ASTM C 33, fine aggregate.

C. Elastomeric Joint Sealant: Multicomponent urethane joint sealant complying with requirements in Division 7 Section "Joint Sealers" for Use NT (nontraffic) and for Use M, G, A, and, as applicable to joint substrates indicated, O joint substrates.

2.05 FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

1. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.01 PREPARATION

A. Prepare uncoated metal flagpole that is set in a foundation tube by painting below-grade portions with a heavy coat of bituminous paint.

B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete.

C. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms and foundation tube, sleeve, or anchor bolts in position, to prevent displacement during concreting.

D. Place concrete immediately after mixing. Compact concrete in place by using vibrators. Moist-cure exposed concrete for not less than seven days or use nonstaining curing compound.

E. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

3.02 FLAGPOLE INSTALLATION

A. General: Install flagpole where shown and according to Shop Drawings and manufacturer's written instructions.

B. Foundation-Tube Installation: Install flagpole in foundation tube, seated on bottom plate between steel centering wedges. Plumb flagpole and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch layer of elastomeric joint sealant and cover with flashing collar.

END OF SECTION

SECTION 10 8200
GRILLES AND SCREENS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum grilles attached to structure.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Mounting substrates.

B. Section 04 2000 - Unit Masonry: Mounting substrates.

C. Section 05 1200 - Structural Steel Framing: Mounting substrates.

D. Section 07 4213 - Metal Wall Panels: Mounting substrates.

E. Section 08 4313 - Aluminum-Framed Storefronts: Mounting substrates.

F. Section 08 4413 - Glazed Aluminum Curtain Walls: Mounting substrates.

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.

B. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2014 (Editorial 2017).

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2014.

D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2013.

E. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs 2017.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Submit detailed shop drawings, indicating component profiles, sections, finishes, fastening details, special details, and manufacturer's technical and descriptive data.

C. Samples: Submit samples for color verification, 10 inches (254 mm) by 10 inches (254 mm) minimum.

D. Samples: Submit assembled sample 24 inches by 24 inches (610 mm by 610 mm) minimum size to illustrate design, fabrication techniques, workmanship and finish color.

E. Design Data: Submit comprehensive structural analysis of design for the specified loads. Stamp and sign calculations by professional engineer.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Perform structural design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in Maryland.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store materials indoors, protected from moisture, humidity, and extreme temperature fluctuations.

PART 2 PRODUCTS

2.01 ALUMINUM GRILLES

A. Aluminum Grilles: Provide shop fabricated, shop finished grilles assembled into panels.

1. Grill Type: Flat bar/egg crate .
2. Grille Type: Tubular shape.
3. Grille Type: Perforated metal sheet.
4. Panel Size and Configuration: As indicated on drawings.
5. Frame/Support: Extruded aluminum tube or flat aluminum bar.
6. Wind Load Resistance: Design to resist positive and negative wind load, [____] psf ([____] kPa), without damage or permanent deformation.

2.02 MATERIALS

A. Aluminum Extrusions: ASTM B221 (ASTM B221M) alloy 6063, temper T5, 1/8 inch (3 mm) minimum wall thickness.

B. Concealed Structural Supports: Aluminum, or steel coated for corrosion resistance and dissimilar metal isolation.

2.03 FABRICATION

A. Shop fabricate grilles to the greatest extent possible.

B. Disassemble as neccessary for shipping and handling, clearly mark units for proper reassembly.

C. Provide supports, anchorages, and accessories as required for complete assembled system.

2.04 FINISHES

A. Superior Performing Organic Coatings: AAMA 2605 multiple coats, thermally cured polyvinylidene fluoride system.

B. Finish Color: As indicated on drawings.

2.05 ACCESSORIES

A. Fasteners: ASTM F593 stainless steel or ASTM A307 carbon steel, sizes to suit installation conditions.

B. Anchors and Inserts: Corrosion resistant; type, size, and material required for loading and installation as indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that painting, roofing, masonry work, and other adjacent work that might damage grille finish has been completed prior to start of installation.

3.02 INSTALLATION

A. Install in accordance with manufacturer's written installation instructions.

B. Set grilles level, plumb, with uniform joints, and in alignment with adjacent work as indicated.

C. Mechanically secure grilles to supporting structure.

D. Do not cut or trim aluminum members without approval of manufacturer; do not install damaged members.

3.03 TOLERANCES

A. Maximum Variation From True Position: 1/8 inch (3 mm).

B. Maximum Offset From True Alignment: 1/8 inch (3 mm).

3.04 CLEANING

A. Clean finished surfaces as recommended by manufacturer and maintain clean condition until Date of Substantial Completion.

B. Touch-up damaged finish coating using material provided by manufacturer to match original coating.

C. Replace grilles that have been damaged beyond touch-up repair.

3.05 PROTECTION

A. Provide protection of installed grilles to ensure grilles are without damage until Date of Substantial Completion.

END OF SECTION

SECTION 101419 - DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cut dimensional characters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals:

1. Product Certificates for Credit MR 5: For products and materials required to comply with requirements for regionally manufactured materials. Include statement indicating cost for each regionally manufactured material.

a. Include statement indicating location of manufacturer and distance to Project for each regionally manufactured material.

2. Product Data for Credit IEQ 4.1: For adhesives, documentation including printed statement of VOC content.
3. Laboratory Test Reports for Credit IEQ 4.1: For adhesives, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings: For dimensional letter signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.

D. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

E. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Dimensional Characters: Full-size Sample each type of dimensional character.
2. Exposed Accessories: Full-size Sample of each accessory type.

F. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify locations of electrical service embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 DIMENSIONAL LETTER SIGNS, GENERAL

A. Regional Materials: Dimensional letter signs shall be manufactured within 500 miles of Project site.

2.2 DIMENSIONAL CHARACTERS

A. Cutout Characters: Characters with uniform faces; square-cut, smooth, edges; precisely formed lines and profiles; and as follows:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. ASI Sign Systems, Inc.
    b. Gemini Incorporated.
    c. InPro Corporation.
    d. Metal Arts; Division of L & H Mfg. Co.
    e. Metallic Arts.
    f. Nelson-Harkins Industries.

2. Character Material: Sheet or plate aluminum.
3. Character Height: As indicated on drawings.
4. Thickness: Manufacturer's standard for size of character.
5. Finishes:

    a. Integral Aluminum Finish: Clear Anodized or Baked Enamel finish. Refer drawings for locations of various finishes.

6. Mounting: Projecting studs
7. Typeface: Arial.

2.3 DIMENSIONAL CHARACTER MATERIALS

A. Aluminum Sheet and Plate: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. Sign Mounting Fasteners:
    a. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.

2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.

2.6 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.7 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

B. Baked-Enamel Finish: AA-M4xC12C42R1x (Mechanical Finish: Manufacturer's standard, other nondirectional textured; Chemical Finish: Chemical conversion coating, acid chromate-fluoride-phosphate pretreatment; Organic Coating: as specified below). Apply baked enamel in compliance with paint manufacturer's specifications for cleaning, conversion coating, and painting.
1. Organic Coating: Thermosetting-modified acrylic enamel primer/topcoat system complying with AAMA 603.8 except with a minimum dry film thickness of 1.5 mils, medium gloss.

    a. Color: As selected by the Architect from the manufacturer's full range of colors or as indicated.

C. Refer drawings for locations of various finishes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.

B. Verify that sign-support surfaces are within tolerances to accommodate individual characters without irregularities between backs of individual characters and support surfaces unless otherwise indicated.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:

1. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101419

SECTION 11 1313
LOADING DOCK BUMPERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Loading dock bumpers of reinforced rubber pads with attachment frame.

1.02 RELATED REQUIREMENTS

A. Section 03 1000 - Concrete Forming and Accessories: Placement of loading dock bumper frame anchors into concrete.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on unit dimensions, method of anchorage, and details of construction.

C. Manufacturer's Installation Instructions: Submit installation requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Loading Dock Bumpers:

1. Blue Giant Equipment Corporation: www.bluegiant.com/#sle.
2. Chalfant Sewing Fabricators, Inc: www.chalfantusa.com/#sle.
3. Durable Corp: www.durablecorp.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 COMPONENTS

A. Loading Dock Bumpers: Molded rubber, ozone resistant, nylon reinforced, Shore A Durometer of 70, minimum, and tensile strength of 950 to 1050 psi (6550 to 7240 kPa), minimum.

1. Projection From Wall: 3 inches (76 mm), minimum.
2. Vertical Height: 10 inches (254 mm), minimum.
3. Width: 5 inches (127 mm), minimum.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that anchor placement is acceptable prior to installation.

3.02 INSTALLATION

A. Install dock bumpers in accordance with manufacturer's instructions.

B. Set plumb and level.

C. Secure angled end frames to concrete; refer to Section 03 1000 for additional information.

D. Weld angled end frames to steel dock frame, and touch up welds with primer.

END OF SECTION

SECTION 11 4001
CUSTOM FABRICATED FOODSERVICE EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Custom fabricated stainless steel units, including:

1. Serving counters and casework.
2. Pot and pan washing sinks.

B. Removal and reinstallation of existing fabricated food service equipment, including:

1. Serving counters and casework.
2. Dishwashers.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Limitations on use of existing facilities and disruption of operation; equipment to be salvaged or removed for re-installation.

B. Section 07 9200 - Joint Sealants: Sealing joints between equipment and adjacent walls, floors, and ceilings.

C. Section 11 4000 - Foodservice Equipment: General requirements covering all food service equipment work; manufactured equipment items.

1.03 REFERENCE STANDARDS

A. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications 2016.

B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

C. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2016.

D. NSF 2 - Food Equipment 2018.

E. SMACNA (KVS) - Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines 2001.

F. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems 2008.

G. UL (DIR) - Online Certifications Directory Current Edition.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's data sheets on each manufactured product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
    a. Coordinate with PGCPS Environmental department for removal of asbestos containing materials.
3. Installation methods.
4. Configuration, sizes, materials, finishes, locations, utility connections and locations.

B. Shop Drawings: Submit floor plans, elevations, cross-sections, and construction details for fabricated units specified, including:

1. Layout and anchorage of equipment and accessories, including clearances for maintenance and operation and required electrical or plumbing connections.
2. Size, type, and location of equipment drain lines and floor drains.
3. Special conditions, including required slab depressions, cores, wall openings, blockouts, ceiling pockets, access panels, and above ceiling hanger assemblies.
4. Wiring, piping, and schematic diagrams.

C. Certificates: Certify that products of this section meet or exceed specified requirements.

D. Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

E. Operation and Maintenance Data: Provide maintenance manual listing routine maintenance procedures, possible breakdowns, repairs, and troubleshooting guides; include instructions for maintenance of stainless steel fabrications and components and simplified diagrams for equipment as installed.

F. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

G. Project Record Documents: Record actual locations of utility connections.

1.05 QUALITY ASSURANCE

A. Manufacturer/Fabricator Qualifications: Company specializing in manufacture of commercial food services equipment with minimum three years documented experience and NSF certified for type of equipment specified.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver fixed equipment that is not to be integrated into structure until after completion of finished ceilings, floor and walls, painting, and lighting.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Tape fiberboard or plywood to surfaces as required by equipment shape and installation access requirements.

D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results, and do not install products under environmental conditions outside manufacturer's absolute limits.

1.08 WARRANTY

A. Correct defective Work within a two year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 PGCPS PREAPPROVED VENDORS: (NO SUBSTITUTION IS ALLOWED; UNLESS THE EQUIPMENT SAYS APPROVED EQUAL). All approved equal items shall be considered as pre-bid approved vendor(s);

2.02 MATERIALS

A. Stainless Steel: 18-8 percent chromium-nickel composition, minimum; alloy Type 302, 304, or 316; No. 4 - Brushed finish on exposed surfaces.

1. Sheets: ASTM A240/A240M or ASTM A666.

2. Tubing: ASTM A269/A269M or ASTM A270/A270M; of true roundness with seams and welds ground smooth.
3. Bars: ASTM A276/A276M.

B. Copper Tubing: ASTM B88; Type L, hard drawn.
1. Fittings: ASME B16.18, ASME B16.22, or ASME B16.26.
2. Solder: ASTM B32, lead-free.
3. Brazing Alloy: AWS A5.8M/A5.8 silver solder.

C. Glass: Fully tempered float glass, 3/8 inch (9.5 mm) thick, minimum.

D. Sound Deadening Material: Bituminous paint or other water resistant mastic.

E. Manufactured Components:
1. Finish Hardware: Manufacturer's standard; stainless steel with polished finish.

F. Bolts, Screws, and Rivets: Stainless steel; do not use on exposed surfaces unless specifically indicated or unavoidable.
1. Bolt and Screw Caps: Provide lock washer and chromium-plated brass/bronze acorn nut to cap visible or exposed threads on inside of fixtures.

G. Anchoring Devices: Stainless steel, of type appropriate for use; provide seismic anchorage as specified in SMACNA (KVS).

2.03 CUSTOM FABRICATED UNITS - GENERAL REQUIREMENTS

A. See drawings for dimensions and configurations; ensure proper fit by taking field measurements prior to fabrication.

B. Provide fully shop assembled units complying with SMACNA (KVS) and NSF 2 and stainless steel components, unless otherwise indicated.
1. Where details are referenced as "SMACNA" details, refer to SMACNA (KVS).
2. Stainless Steel Sheet: For surfaces up to 12 feet (3.7 m) in length provide one continuous sheet without joints or welds, including back and end splashes.
3. Joints: Provide welded joints unless specifically indicated or not possible; do not solder or braze stainless steel; do not use bolts, screws, or other fasteners on work surfaces, food contact surfaces, or wet surfaces.
4. Drainage of Surfaces: Provide distinct pitch of top surfaces toward waste or drain outlets while maintaining level tops of rolled and marine edges and back and end splashes.
5. Drainage of Equipment: Provide drain piping as indicated; where compartments or pans are intended to hold liquids or catch drips and no drain piping is indicated, provide drain fitting and gravity draining piping terminating over nearest floor drain.
6. Where cut-outs are indicated for equipment to be set into countertop, provide cut-out in top and back of case body, maintaining continuous counter front; size to fit equipment with sanitary joint.
7. Wiring: Concealed in enclosed portions or corner posts.
8. Shop prepare openings for plumbing fixtures, fittings, and other service components.
9. Sound Deadening: Apply sound deadening material to accessible internal surfaces of metal work and underside of metal counters and sinks.

C. Sneeze Guards: Fully tempered float glass mounted in stainless steel channel frames; provide adjustable brackets allowing easy loading of food trays.

D. Tray Slides:

1. Construction: Closed, solid stainless steel 14 gage, 0.0747 inch (1.9 mm) thick, with three lengthwise inverted "V" ridges of solid stainless steel, front edge rolled, back edge turned up behind counter top turndown, and ends closed.

2. Support Brackets: Stainless steel.

E. Flatware Dispensers: Removable stainless steel containers recessed into counter top.

1. Containers: Rectangular compartments; stainless steel, 18 gage, 0.0478 inch (1.2 mm) thick.

2. Size and Quantity: As indicated on drawings.

2.04 SERVING COUNTERS

A. Serving Counter Height:

1. Self-Service: 27 inch (685 mm).

2. Non-Self-Service: 36 inch (905 mm).

B. Tray Slide Height: 30 inch (762 mm).

C. Tray Stands: Tray storage surface 15 inches (381 mm) above floor; constructed as integral part of counter top.

2.05 FABRICATION

A. Joints, Bends, and Edges: Make each joint close fitting, especially butt and contact joints.

1. Make brake bends free of open-texture or orange peel appearance.

2. Make sheared edges free of burrs, projections, and fins.

3. Neatly finish mitered and bullnosed corners with under edge of material ground to uniform condition, without overlapping materials or cracks.

B. Welding: Make each welded joint smooth, ductile, and watertight, without gaps, holes, or discoloration or marring of surface adjacent to welds.

1. Use welding processes and filler metal compatible with material being welded. Do not use carbon arc welding on surfaces that will be exposed to view in finished work.

2. Grind exposed welds flush with adjacent material; finish and polish to match adjacent surface.

a. Avoid excessive heating of metal and metal discoloration.

b. When grinding, use iron-free abrasives, wheels, and belts that have not been used on carbon-steel.

c. Remove pits, runs, sputter, cracks, low spots, voids, buckles, and other imperfections.

d. Remove grain of rough grinding by several successively finer polishings until specified finish is attained.

3. When welding sheet, penetrate entire thickness for entire length of joint; make joints flat, continuous and homogeneous with sheet metal without reliance on straps under seams, filling with solder, or spot welding.

4. When stainless steel is joined to dissimilar materials, use stainless steel for fastening devices and welding material.

5. Protection Against Corrosion: Eliminate possibility of corrosion wherever welding occurs on stainless steel, and minimize possibility of carbide precipitation in welding bolts and screws.
6. When welding galvanized steel, thoroughly clean and repair damaged galvanizing and coat welds with polyurethane coating.
7. Where bolts or screws are welded to underside of tops or trim, finish and undepress the exposed side of welds.
8. Coat welds and discolorations that are not exposed to view in finished work with metallic-based paint to prevent the possibility of progressive corrosion of joints, unless welds are ground and polished smooth.

C. Brazing of Copper Tubing to Brass and Bronze Fittings: Use silver solder, and do not braze stainless steel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Owner shall fully inspect all equipment prior to install for defects and report back to vendor.

C. Verify correct locations of utility connections, floor drains, ventilation connections, and supports.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under project conditions.

3.03 INSTALLATION

A. Install in accordance with fabricator's instructions and recommendations, plumb and level and in proper locations, ready for utility connections.

B. Lay out work in advance to prevent damage to building, piping, wiring, or equipment; cut, fit, and patch where necessary; coordinate work with others.

C. Do not cut or fit units in the field; if adjustments are necessary due to inadequate field measurement prior to fabrication, take unit back to shop and perform modifications there.

D. Do not field weld unless absolutely necessary; weld and grind field joints in accordance with specified fabrication procedures.

E. Securely anchor and attach non-mobile or adjustable-leg equipment to walls, floors, or bases with stainless steel bolts.

F. Follow SMACNA (SRM) seismic restraint recommendations for project location.

G. Reinstall existing equipment in same manner as for new.

3.04 ADJUSTING

A. Adjust new and existing equipment to ensure proper operation.

3.05 CLOSEOUT ACTIVITIES

A. Demonstrate operation of foodservice equipment and identify potential operational problems. Contractor shall also demonstrate proper repair techniques to Owner.

3.06 CLEANING

A. Remove masking or protective covering from stainless steel and other finished surfaces.

B. Clean equipment to condition suitable for food preparation use.

3.07 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 11 4640
FOOD SERVICE EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General Conditions and other Division 1 Specification Sections, apply to the Work of this Section.

1.02 DESCRIPTION OF WORK

A. The extent of food service equipment provided is indicated on the Drawings and in the equipment schedule of this Section.

B. All food service equipment shall be set in place, ready for final connection to all required plumbing, electrical and ventilating rough-ins.

1.03 RELATED WORK

A. Refer to applicable Sections of Divisions 22, 23 and 26, covering rough-in work necessary for final connections and proper function of equipment provided under this Section.

B. All plumbing fittings and accessories, unless specifically called for in the equipment list, shall be provided under Division 23 specifications. All final plumbing connections shall be performed under Division 23 specifications.

C. All fans and ductwork, including final connections of equipment to such items, shall be provided under the provisions of Division 23 specifications, unless specifically called for in this Section.

D. All electrical devices shall be provided under Division 26 specifications, unless specifically called for in the equipment list, and unless such devices are integral to the equipment item. All final electrical connections shall be performed under Division 26 specifications.

1.04 QUALITY ASSURANCE

A. Food service equipment suppliers shall demonstrate satisfactory evidence of compliance with the following qualifications and conditions:

1. Successful completion of projects of comparable scope for a period of not less than three (3) years.
2. Possess manufacturer's authorization to distribute specified factory produced equipment items.
3. Maintain or have access to readily available stock of repair and replacement parts for factory produced equipment items.
4. Maintain or have access to factory authorized personnel in the metropolitan Washington, D.C. area for repair and maintenance of factory produced equipment.
5. Maintain or have access to fabrication shop complying with National Sanitation Foundation (NSF) requirements for custom fabricated items specified in the equipment list.

B. Standards for Food Service Equipment:

1. NSF Standards: Comply with applicable NSF standards and recommended criteria. All food service equipment shall bear the NSF Seal of Approval.
2. U.L. Labels: Provide U.L. labels on those equipment items possessing prime electrical components. Provide U.L. Recognized Marking on other items with electrical components, signifying U.L. listing.
3. ANSI Standards: Comply with applicable ANSI standards (ANSI Z21; B57.1, A40.6 and A40.4).
4. Comply with the National Electrical Code, latest adopted edition, and with NFPA No. 96 for exhaust system equipment.

5. ASME Boiler Code: For steam generating and steam heated equipment, comply with applicable ASME requirements, including inspections, stamps and equipment registration with the National Board.
6. American Gas Association Laboratories: Comply with applicable AGA standards and recommendations for gas-fired equipment.

1.05 SUBMITTALS

A. Product Data: Submit manufacturer's product specifications and installation instructions for each item. Include the following:
   1. Elevations of equipment showing rough-in dimensions, equipment size, and locations of service connections.
   2. Types of service connections and utility requirements.
   3. Performance characteristics.

B. Shop Drawing Submittals: Submit plans, elevations, sections and details of custom fabricated items and of assembled units made up of manufactured equipment. Submit rough-in plan showing required services and connections by size and locations.

C. Samples: Submit samples of exposed finishes for both manufactured and custom fabricated equipment.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store food service equipment in undamaged condition, in original packaging, protected from weather, construction hazards, and unauthorized access.

B. Wrapping and protective coverings shall remain on all items until ready for final placement. Stainless steel equipment shall remain covered until installation is complete.

1.07 EQUIPMENT DEMONSTRATION

A. Subsequent to final connection, provide demonstration of operable equipment to Owner’s food service personnel. Demonstration shall be conducted by equipment manufacturer’s authorized representative in order to ensure proper and safe function and operation.

1.08 OPERATION AND MAINTENANCE DATA

A. Comply with Division 0 requirements for operation and maintenance manuals.

1.09 WARRANTIES

A. All manufactured and custom fabricated food service equipment shall be warranted against defects in workmanship for a period of two (2) years. Parts shall be warranted for a minimum period of two (2) years. List each item of equipment along with the authorized service agency. Refer to food service equipment list for additional warranties.

B. PGCPS Authorized Service Agencies:
   1. Electric Motor Repair, Company (EMR)
   2. Ocean Air Refrigeration

PART 2 - PRODUCTS

2.01 APPROVED VENDORS

A. PGCPS PREAPPROVED VENDORS: (NO SUBSTITUTION IS ALLOWED; UNLESS THE EQUIPMENT SAYS APPROVED EQUAL). All approved equal items shall be considered as pre-bid approved vendor(s);
   1. Ashland Equipment

2. American Energy
3. Acme Paper (Milk Coolers)
4. Sam Tell and Sons (Utility Carts)

2.02 MATERIALS

A. Metals:

1. AISI type 302/304, hardest workable temper; No. 4 directional polish.
2. Galvanized Steel Sheet: ASTM A 526, except ASTM A 527 for extensive forming; ASTM A 525, G90 zinc coating, chemical treatment.
    a. Where painted finish is indicated, provide mill phosphatized treatment in lieu of chemical treatment.
3. Steel Sheet: ASTM A 569 hot-rolled carbon steel.
4. Galvanized Steel Pipe: ASTM A 53 or ASTM A 120, welded or seamless, Schedule 40, galvanized.
5. Steel Structural Members: Hot-rolled or cold formed, carbon steel (unless stainless steel is indicated).
6. Galvanized Finish: ASTM A 123, apply after fabrication.
7. Aluminum: ASTM B 209/B221 sheet, plate and extrusions as indicated. Alloy, temper and finish: 0.40 mill natural anodized finish unless indicated otherwise.

B. Plastic Laminate:

1. NEMA LD3 general purpose, high-pressure type, minimum 0.05" thick, except 0.042" for post-forming, non textured. Color: As selected by Architect. Comply with NSF No. 35 where applicable.

C. Insulation:

1. Cooling component type: Rigid, closed cell polyurethane foam; slab stock for adhesive lamination with face sheets, or foamed in place. K- value = 0.15 maximum.
2. Heating component type: Rigid board, semi-rigid blanket of glass fiber or mineral fiber insulation, certified for long term heat exposure without deterioration; K-value = 0.30 maximum.

D. Joint Materials:

1. Sealants: One-part polyurethane or silicone based liquid elastomeric sealant complying with FS TT-S-00277 or FS-TT-S-00230; non-solvent release type, mildew-resistant, Shore A hardness of 45 minimum.
2. Backer Rod: Polyethylene rod stock, diameter larger than width of joint.
3. Gaskets: Solid or hollow (not cellular) neoprene or PVC; shore A hardness of 40 minimum, self-adhesive or designed for adhesive application or mechanical anchoring.

E. Paints and coatings:

1. Painting and coating materials shall be suitable and approved for use in conjunction with food service operations; durable, non-toxic, non-dusting and non-flaking, mildew-resistant, complying with USDA and NSF recommendations for food service.
2. Colors: As selected by Architect from manufacturers full range of standard colors.

2.03 FABRICATED EQUIPMENT

A. General: Provide manufacturers' standard equipment, except as modified; in no case shall compliance be less than the standards of ANSI A156.9 (BHMA Standard 201), Type 2 Institutional; satin finish stainless

steel or dull chrome finish.

B. Plumbing Fittings, Trim and Accessories: Where exposed or semi-exposed to view, provide bright chrome-plated brass or polished stainless steel units. Where not exposed to view, provide copper or brass.

1. Vacuum Breakers: Provide with food service equipment, including locations where water outlets are outfitted with hose attachment.
2. Water outlets: Include manual shut-off valves and connecting stem pipes to permit outlet servicing without shutdown of water piping supply systems.

C. Electrical Materials:

1. Controls and Signals: Provided commercial grade signals, "on-off" push buttons or switches, speed and temperature controls, pilot lights, graphics, etc., for items as indicated, complete with steel cover plates.
2. Connections: Equip electrically operated items with either a terminal box for permanent connection, or standard gray grounded cord and plug for interruptible connection, based upon equipment specification. Coordinate with Division 16 for correct electrical rough-ins and matching receptacles.
3. Motors: Enclosed type, except drip-proof type where not exposed to dust or moisture. Windings shall be impregnated to resist moisture. Provide proper horsepower and duty-cycle ratings for the service required.
4. Nameplates: Locate nameplates and labels in accessible location, out of customer view where possible. Custom fabricated items require only those labels required to indicate compliance with regulations or performance.

2.04 METALWORK FABRICATION

A. General Requirements: Remove burrs from cut edges of metal, ease corners and make smooth to eliminate cutting hazard. Bend metal sheets at not less than minimum radius required to avoid grain separation. Maintain flat, smooth surfaces.

B. Reinforce metal at locations of hardware, anchorages, and accessory attachment, where metal is of less than 14 gauge, or mortised condition exists. Conceal reinforcement.

C. Fastenings: Machine screws capped with acorn nuts unless fully concealed. Provide nuts and lockwashers unless metal to be fastened is at least 12 gauge. Fastener heads and nuts shall be of the same alloy as the metal to be fastened.

D. Welding: Arc-weld fabricated items using stainless steel electrodes. Welds to be free of pits and flaws, peened to remove flux, and ground smooth.

1. Where components of metal work are to be galvanized, and involve welding or machining of minimum 16 gauge metal, hot-dip galvanize such components subsequent to fabrication to the greatest extent possible. Comply with applicable requirements of ASTM A 123.

E. Provide removable panels for access to concealed mechanical and electrical service connections, where such connections are not otherwise accessible.

F. Minimum metal gauges: Except as otherwise specified, fabricate exposed metal work of stainless steel, and of the following gauges; in no case shall metal be less than 20 gauge:

1. Table tops: 14 gauge
2. Table frames: 1 5/8" O. D. tubing
3. Counter tops: 14 gauge

4. Shelves: 16 gauge, except 18 gauge if less than 12 wide
5. Front Drawer/Door Panels: 18 gauge, double pan type
6. Single pan Doors and Drawer Fronts: 16 gauge
7. Enclosed base cabinets: 18 gauge
8. Enclosed wall cabinets: 18 gauge
9. Sinks and drainboards: 14 gauge
10. Sink compartment covers: 16 gauge
11. Exhaust Hoods: 18 gauge
12. Pan type Insets and Trays: 16 gauge
13. Removable covers and panels: 18 gauge
14. Skirts/Enclosure panels: 18 gauge
15. Closures and trim strips: 18 gauge
16. Hardware reinforcement: 12 gauge
17. Gusset plates: 10 gauge
18. Tray Slide: 14 gauge

G. Work Surfaces: Fabricate to provide seamless construction, ground and polished. Reinforce work surfaces 30" o. c. both ways. Reinforce edges not self-reinforced by forming. Sound-deaden the underside of work surfaces, including sinks.

H. Structural Framing: Except as otherwise specified, provide framing of minimum 1" round pipe or tube, with mitered and welded joints and gusset plates, ground smooth. Use stainless steel tube for exposed framing and galvanized steel tube for concealed areas.

I. Shop Painting: Clean and prepare metal surfaces to be painted; remove rust and dirt. Apply treatment to zinc-coated surfaces that have not been mill• phosphatized. Coat welded and abraded areas of zinc-coated surfaces with galvanized touch-up paint.

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION

A. Rough-in Work: Food Service Equipment Drawings are diagrammatic. Coordinate with General Contractor for the following field conditions:

1. Types and locations of roughed-in utilities and direct utility connections designed to serve specified equipment.
2. Conditions of floor, wall, column and ceiling installations that may affect placement of specified equipment.
3. Dimensions and clearances affecting correct placement of specified equipment.

B. Notify Architect and Owner’s Representative in writing of any deficiencies and discrepancies that would affect final placement, utility connection, and proper operation of specified equipment. Do not proceed with fabrication and placement until such conditions have been corrected, or until request for corrective changes have been submitted, reviewed and approved by the Architect and Owner’s Representative.

3.02 INSTALLATION

A. Set each item of equipment securely in place, ready for final utility connection, leveled and adjusted to correct height. Anchor where indicated and required for sustained operation and use without shifting.

Conceal anchorages. Adjust counter tops and other work surfaces to a level tolerance of 1/16" maximum offset, and maximum variation from level or specified slope of 1/16" per foot.

B. Work Surfaces: Fabricate to provide seamless construction, ground and polished. Reinforce work surfaces 30" o. c. both ways. Reinforce edges not self-reinforced by forming. Sound-deaden the underside of work surfaces, including sinks.

C. Complete field assembly of those joints that cannot be shop fabricated.

D. Where conditions require submerged water inlets, equip plumbing fixtures with a vacuum breaker and check valve (See Division 23).

E. Treat enclosed spaces that are inaccessible after installation with powdered borax at a rate of 4 ounces per square foot on horizontal spaces.

F. Install closure plates and trim strips where required.

G. Install sealants and gaskets all around each unit to make joints airtight, waterproof, vermin-proof, and sanitary for cleaning purposes. Provide sealant filled (rod backed) or gasketed joints where joints are 3/4" or less; provide metal closures for wider joints, with sealant each side of strip. At internal corner joints, apply sealant or gaskets to form a sanitary cove, of not less than 3/8" radius.

3.03 CLEANING AND REPAIR OF FINISHES

A. After completion of installation, and completion of other major work in food service area, remove protective coverings and thoroughly clean equipment inside and out. Restore exposed and semi-exposed finished where abraided or otherwise damaged; polish exposed metal surfaces and touch-up painted surfaces. Any work that cannot be restored to a smooth, even finish shall be replaced.

3.04 START-UP, TESTING, INSTRUCTION AND DEMONSTRATION

A. Do not start-up or test food service equipment until utility service lines have been tested, balanced and adjusted for pressure, voltage and similar performance characteristics. Water and steam lines shall be clean and sanitation treated prior to start-up and testing.

B. Test each item of operational equipment in the presence of the Owners Representative, to demonstrate proper performance and to show that controls and safety devices are functioning correctly. Provide burn-in time for all equipment as required by equipment manufacturer. Repair or replace equipment that is found to be defective, including items, which are below capacity or operating with excessive noise or vibration. Start-up and re-test or test repaired or replaced equipment.

C. Instruct Owners' operating personnel in proper operating and maintenance procedures for each item of operational equipment.

1. Contractor shall provide Owner a minimum of twenty (20) hours of training on equipment at the conclusion of installation of all kitchen equipment.

2. Contractor shall provide Owner a minimum of thirty-six (36) hours of training on all combination ovens, refrigeration, and exhaust equipment at the conclusion of install.

3.05 FINAL CLEANING

A. After testing and start-up, and prior to Owner acceptance, clean and sanitize all food service equipment, and leave in condition ready for operation by Owners' food service personnel.

END OF SECTION

SECTION 11 5119
BOOK THEFT PROTECTION EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes library security system.

B. Related Section include the following:

1. Division 26 Sections for electrical service.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's standard details and installation and maintenance instructions.

B. Shop Drawings: Include plans, elevations, and details of typical members and other components. Show layout and installation details, including anchorage details.

1. Wiring Diagrams: Detail wiring for control equipment operator, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring. Show locations of connections to electrical service provided in other Sections.

C. Maintenance Data: For library security system components to include in maintenance manuals.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who is an authorized representative of the library security system manufacturer for both installation and maintenance of the type of units required for this Project, and who installations have resulted in construction with a record of successful in-service performance.

B. Source Limitations: Obtain library security control equipment through one source from a single manufacturer.

C. Product Options: Specifications indicate basis of design product for establishing aesthetic and performance requirements. Aesthetic effects are dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance. Refer to Division 1 Section "Product Requirements."

1. Do not modify intended aesthetic effects or performance characteristics, as judges solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Listing and Labeling: Provide internal electrical components required as part of library security system specified in this Section that are UL-listed and labeled.

E. Regulatory Requirements: Comply with the Americans with Disabilities Act Accessibility Guidelines.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.

2.02 LIBRARY SECURITY SYSTEM

A. Detection System: Single-corridor system with audible and visible alarms; 43-inch-wide aisles; mounted directly to floor, complete with all magnetic media; with 10-foot power cord complying with the following requirements:

1. Connecting cables buried in concrete floor.
2. Remote digital electronics.
3. Very low frequency system.
4. Adjustable height detection zone.
5. Keyed on/off switch.
6. Provide a remote re-set switch at the circulation desk.
7. Available Products: 3M Library Systems; Detection System Model 3501.

B. Accessories: Provide the following:

1. Desensitizer Unit for Print Material: Desktop unit for desensitizing security strips on nonmagnetic materials.
    a. Available Product: 3M Library Systems; Model 930.
2. Book Check Unit: Desensitizes or resensitizes security strips on nonmagnetic materials.
    a. Available Product: 3M Library Systems; Model 955.
3. Desensitizer and Resensitizer Unit for Non-print Materials: Desensitizes and resensitizes security strips on videocassettes, DVDs, and CDs without removing from cases.
4. Provide the following security strips:
    a. For Hardcover Books: 4 cases of 5,000 strips per case.
    b. For Periodicals: 1 case of 5,000 strips.
    c. For CDs, CD-ROMs, and Single-sided DVDs: 1 case of 1,000 strips.
    d. For Videocassettes: 1 case of 1,000 strips.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas to receive library security system equipment, with Installer present, for conditions affecting performance. Verify that critical dimensions are correct and conditions are acceptable. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install library security system equipment according to manufacturer’s written instructions and shop drawings.

3.03 CLEANING AND PROTECTION

A. Clean finished surfaces after completing installation.

B. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer, that ensure library security system equipment is without damage or deterioration at the time of Substantial Completion.

3.04 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain library security system. Train personnel on procedures to follow if operation fails or malfunctions.

B. Refer to Division 1 Section "Closeout Procedures."

END OF SECTION

SECTION 11 5123
LIBRARY STACK SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following types of library stack shelving systems:

1. Wood end and intermediate panels; steel shelves.

1.02 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for library stack systems and accessories specified.

B. Shop Drawings: Show fabrication and installation details for library stack systems and methods of anchoring to building structure. Include clear aisle widths from face of units.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Size: 6 inches square.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of steel bracket shelving used.

E. LEED Submittals:

1. Credit EQ 4.1: Manufacturers' product data for installation adhesives, including printed statement of VOC content.
2. Credit EQ 4.4:
    a. Composite wood manufacturer's product data for each composite wood product used indicating that the bonding agent contains no urea formaldehyde.
    b. Adhesive manufacturer's product data for each adhesive used indicating that the adhesive contains no urea formaldehyde.
3. Credit MR 4: Recycled content data designating percentages of post-consumer and post-industrial material.
    a. Include statement indicating costs for each product having recycled content.
4. Credit MR 7 (Alternate Bid): Certificates of chain-of-custody signed by manufacturers certifying that products specified to be made from certified wood were made from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria." Include evidence that mill is certified for chain-of-custody by an FSC-accredited certification body.
5. Credit MR 5.1 and 5.2:
    a. Include statement indicating cost and distance from manufacturer to Project for each regionally manufactured material.
6. Include statement indicating cost and distance from point of extraction, harvest, or recovery to Project for each raw material used in regionally manufactured materials.

F. Maintenance Data: For library stack systems to include in maintenance manuals.

G. Warranty: Special warranty specified in this Section.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer for installation of units required for this Project.

B. Source Limitations: Obtain library stack systems through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of library stack systems and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

1. Do not modify requirements, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Forest Certification: Provide wood made from forests certified by an FSC□accredited certification body. All non□FSC wood in assemblies with FSC□certified wood shall meet the FSC Controlled Wood (CW) criteria.

1.04 PROJECT CONDITIONS

A. Field Measurements: Indicate measurements on Shop Drawings.

1.05 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of library stack system that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of metals, metal finishes, and other materials beyond normal wear.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 STEEL MATERIALS

A. Steel Sheet: Uncoated, cold-rolled, steel sheet substrate complying with ASTM A 1008, Commercial Steel (CS), exposed.

2.02 WOOD MATERIALS

A. Solid Wood: Clear hardwood lumber, selected for compatible grain and color.

1. Wood Species and Veneer Cut: Northern Grown Hard Maple.

B. Veneer-Faced Panels: HPVA HP-1, with face veneer of species indicated, with Grade A faces, urea-formaldehyde free.

1. Wood Species and Veneer Cut: Northern Grown Hard Maple.

C. High-Pressure Decorative Laminate (Work Surfaces): NEMA LD 3, Grade HGL, urea-formaldehyde free.

1. Colors, Textures, and Patterns: As selected by Architect from manufacturer's full range.

2.03 WOOD CASE SHELVING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Community.

2. Brodart Co.; Contract Library Furniture Division.

3. Jasper Library.

4. Library Bureau; a ModuForm Company.

5. Worden Company (The).

B. Wood Case Library Shelving: Shelving designed for library use and consisting of full end, top, and back panels, with end panels made to receive pins to support adjustable shelves.

1. Configuration: Starter/adder units.

C. Vertical Panels: Panels consisting of solid hardwood boards glued together, 3/4 inch thick, or urea-formaldehyde free veneer panels, 5 ply, 1-inch thick, with 1/4-inch solid-wood banding. Provide 2 rows of holes at 1-1/4-inch intervals for 5/16-inch shelf support pins on 1 side of end panels and both sides of intermediate panels.

D. Base Frames: Solid hardwood toe kick, back rail, and 2 end cleats, 3 to 4 inches high, designed to support bottom shelf and fabricated to attach and tie together vertical panels.

E. Steel Shelves: Manufacturer's standard 0.048-inch- thick, cold-rolled steel shelves.

F. Back and Divider Panels: Urea-formaldehyde free veneer-faced panels, 0.25 inch thick.

G. Bookstack Units:

1. Type: Single-faced units as indicated.
2. Width: 36 inches, unless indicated otherwise on Drawings.
3. Height: 30, 42, and 63 inches as indicated.
4. Number of Shelves: As indicated on Drawings.
5. Shelf Depth: 12 inches nominal; 24 inch nominal for picture and big books.
6. Shelf Styles: As indicated, including the following:
    a. Flat.
    b. Picture books.
    c. Big books.

2.04 ACCESSORIES

A. Shelf Label Holders: Clear plastic, 5 inches long, designed to snap over adjustable shelves.

1. Provide one per shelf.

2.05 STRUCTURAL SUPPORT

A. Floor Anchorage: Galvanized steel, post-installed expansion anchors or power-actuated fasteners. Provide number per unit recommended by manufacturer.

B. Wall Anchorage: Manufacturer's standard, galvanized steel anchor designed to secure shelving to adjacent wall. Provide one per shelving unit for each shelving unit adjacent to a wall.

2.06 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating metal finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.07 STEEL FINISHES

A. Baked-Enamel/Powder-Coated Finish: Immediately after cleaning and pretreating, apply manufacturer's standard baked-on finish. Comply with coating manufacturer's written instructions for applying and baking.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

2.08 WOOD FINISHES

A. Preparation: Sand shelving units after assembling for uniform smoothness at least equivalent to that produced by 220-grit sanding and without machine marks, cross sanding, or other surface blemishes.

B. Staining: Remove fibers and dust and apply wash-coat sealer and stain to exposed and semiexposed surfaces as required to provide uniform color and to match approved samples.

C. Finishing: Apply manufacturer's standard, baked, clear finish consisting of a sealer and a conversion varnish or nitrocellulous lacquer topcoat. Sand and wipe clean between applications of sealer and topcoat.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine conditions, with Installer present, for conditions affecting performance of library stack systems.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Vacuum finished floor over which shelving is to be installed.

3.03 INSTALLATION, GENERAL

A. Install library stack systems according to manufacturer's written instructions.

B. Level bookstack units with integral adjustable leveling devices to a tolerance of 1/8 inch in 96 inches for level and plumb.

C. Install the following with concealed fasteners:

1. End panels.
2. Canopy tops.
3. Countertops.

D. Install shelves at spacing indicated or, if not indicated, at equal spacing in each unit.

END OF SECTION

SECTION 11 5215
INTERACTIVE WHITEBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interactive whiteboards/markerboards.

1.02 RELATED REQUIREMENTS

A. Section 06 1000: Rough Carpentry

B. Section 09 2116: Gypsum Board Assemblies

C. Section 09 2216: Non-Structural Metal Framing

D. Section 26 0530: Conduits, Raceways, Fitting and Cable Trays

E. Section 26 0537: Wire, Cable and Connectors

F. Section 27 0500: LAN Wiring Specifications

1.03 REFERENCE STANDARDS

A. ANSI A135.4 – American Standard for Basic Hard Board; 2012

B. ASTM C1396/C1396M – Standard Specification for Gypsum Board; 2017

C. ASTM E84 – Standard Test Methods for Surface Burning Characteristics of Building Materials; 2018b

D. PS 1 – Structural Plywood; 2009.

E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL (DIR) - Online Certifications Directory Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

C. The work covered by this section of the specifications shall include all material, labor, hardware, software, firmware and programming to install interactive whiteboards as described herein and shown on the drawings.

D. System shall utilize PGCPS shared data network, and not require the use of any proprietary switches, routers or other network components. Physical network connections shall be provided by PGCPS' specified contractor.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate wall elevations, dimensions, joint locations, special anchoring details.

C. Cut sheets: indication specific manufactures information on software, model and accessories (mobile stand, pens, remote, etc.).

D. Manufacturer’s printed installation instructions and quality statement.

E. Installer's Qualification Statement.

F. Maintenance Contracts.

G. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

H. Project Record Documents: Record actual locations of all boards locations and model numbers.

I. Software: Copy of software provided under this section.

J. Maintenance Materials: Furnish the following for Owner's use in the maintenance of project:

1. Extra Stock Materials: Provide 5% attic stock of equipment or replacement bulbs, fuses, etc. for all equipment provided under this section.

2. Tools: One each of every special tool required for maintenance of specified equipment.
3. Maintenance Data: Include data on regular upkeep cleaning, thorough cleaning, removing permanent marker ink, sensor cleaning, etc.

1.06 **QUALITY ASSURANCE**

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

C. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

D. Testing and Certification: Interactive display provider must invest in accelerated life testing (ALT) to demonstrate expected failure rate, life of the product and make design changes to mitigate risk

1.07 **MOCK-UP**

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

1.08 **DELIVERY, STORAGE, AND HANDLING**

A. Deliver products to project site in factory packaging.

1.09 **WARRANTY**

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty for warranty against pixilation; backlight power issues, general electrical defects, or manufacturer’s defects, etc.

D. Warranty upgrade: Three (3) year upgrade to onsite support with remote support.

E. Provide one-year warranty for floor stands, speakers, and mobile stands from date of purchase.

PART 2 PRODUCTS

2.01 **MANUFACTURERS**

A. Boxlight (www.boxlight.com).

B. Smart (www.smarttech.com).

C. Viewsonic (www.viewsonic.com).

2.02 **EQUIPMENT REQUIREMENTS**

A. Basis of Design Manufacturer: reference BOD.

B. General:
1. At a minimum, interactive display models must be available with a 75-inch screen size (diagonal).
2. Board/Panel can function without a supplementary device (laptop, tablet) Runs an independent operating system preferably Microsoft Windows
3. Must be a Stand-alone panel
4. Board can be mobile on cart or mounted to wall/structure
5. Unit shall carry Energy Star certification
6. Display must integrate with other products from the display provider, including software, document cameras, speakers and classroom audio systems
7. Unit shall be provided with all required cables including USB, HDMI, power, audio, etc.
8. Must feature 4K UHD (ultra-high definition) resolution as well ass support 4K UHD 60Hz digital input.

C. Performance:
1. Units shall be equipped with the following:
   a. Wired ethernet and wireless internet connection
   b. Bluetooth connection

c. Auxiliary remote control
d. Ease of connection and display with PC, Apple and Android devices
e. HDMI connections
f. Interactive pens or other tools including ability to draw or activate features by finger
g. Automatic software updates for ease of function
h. Touch screen
i. Video conferencing
j. Integrated speaker system and ability to output audio through external speakers
k. Memory and Storage capabilities (including storage to Google Drive)

D. Information Technology Hardware and Software Requirements
1. Prouduct must be capable of running an independent Operating System (i.e. - Chrome OS).
2. Shall have ability to connect to a hardwired network via ethernet port.
3. Software shall have ability to support enterprise wireless - 802.11x
4. Unit shall support user installed SSL certificates.
5. Unit shall have a minimum of three (3) USB inputs.
6. Unit shall have two (2) HDMI inputs.
7. Unit shall have one (1) 3.5 mm audio input.
8. Unit shall have one (1) 3.5 mm audio output.
9. Corded power cable connection only; no hard wired equipment.

E. Mounting Carts
1. Legs on mobile stand shall not be tripping hazard.
2. Owner preferred option: shelving below board.
3. Mounting carts shall be adjustable such that unit height should be easily adjustable for variable student heights.

2.03 **SOURCE QUALITY CONTROL**

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Non-Complying Work: See Section 01 4000 - Quality Requirements.

PART 3 EXECUTION

3.01 **INSTALLATION**

A. Install in accordance with manufacturer's instructions.

B. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.
1. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.
2. Verify flat wall surface

C. Refer to educational specifications for mounting heights of boards in classrooms.

D. Systems Integration:
1. All connections to PGCPS network shall be done in accordance with Section 27 0500 - LAN Wiring Specifications.
2. Verify in field that equipment is installed plum and level.
3. Mounting system shall include all necessary accessories and devices for complete installation and operation. Finch/color shall be coordinated with the architect. Ensure all equipment is hung on manufacturer approved brackets, etc. according to equipment weights. All connections to walls shall be coordinated with wall types outlined in architectural drawings.
4. Connection ports shall be coordinated with in-school staff and PGCPS Information Technology.

3.02 **CLEANING**

A. Clean board surfaces in accordance with manufacturer's instructions.

B. Cover with protective cover, taped to frame.

C. Remove temporary protective cover at Date of Substantial Completion.

3.03 **CLOSEOUT ACTIVITIES**

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate operation of system to Owner's personnel.
   1. Use operation and maintenance data as reference during demonstration.
   2. Briefly describe function, operation, and maintenance of each component.

D. Training: Train Owner's personnel on operation and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Manufacturer's training personnel.
   4. Location: At project site.

3.04 **PROTECTION**

3.05 **MAINTENANCE**

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide a separate maintenance contract for specified maintenance service.

END OF SECTION

SECTION 11 5300
LABORATORY EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Contractor-furnished laboratory equipment including CFOI equipment installed by Owner.

B. Installation of Contractor-furnished (CFCI) equipment.

C. Installation of Owner-furnished (OFCI) equipment.

D. Coordination with Owner-furnished Owner-installed (OFOI) equipment.

1.02 REFERENCE STANDARDS

A. NEMA MG 1 - Motors and Generators 2017.

B. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems 2008.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate installation of laboratory equipment with laboratory casework and Owner-furnished, Owner-installed laboratory equipment.

B. Preinstallation Meeting: Convene one week before starting work of this section.

C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide equipment dimensions and construction; equipment capacities; physical dimensions; utility and service requirements, clearances, and locations; required accessories and optional features; point loads.

C. Shop Drawings: Indicate equipment locations, large scale plans, elevations, cross sections, rough-in and anchor placement dimensions and tolerances, installation and servicing clearances required.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's Qualification Statement.

F. Installer's Qualification Statement.

G. Operation Data: Include description of equipment operation and required adjusting and testing.

H. Maintenance Data: Identify system maintenance requirements, servicing cycles, lubrication types required and local spare part sources.

I. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

J. Project Record Documents: Record actual locations of concealed utility connections.

1.05 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the types of products specified in this section, with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience and approved by manufacturer.

C. Preconstruction Testing: Factory-test each type of equipment.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package each piece of equipment to ensure protection from damage during shipment and delivery. Legibly indicate on the exterior of each container or crate, the shipping address and a brief description of its contents. Outside of the container, fasten a waterproof envelope containing a packing list and complete instructions for uncrating and setting the equipment in place.

B. Protect finished surfaces during handling and installation with protective covering of polyethylene film or another suitable material.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a two year period after Date of Substantial Completion.

C. Provide ten year manufacturer warranty for materials, parts, and labor for sterilizer chamber.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Comply with applicable codes for all equipment.

B. Comply with UL requirements for fabrication and installation of all equipment.

2.02 EQUIPMENT

A. Each item energized by a single switch.

B. Prewire and prepipe each unit of equipment complete with trim and fittings. Include reduced pressure or atmospheric type backflow preventer fitting to prevent backflow of polluted water or waste into water supply system or equipment. Comply with applicable code requirements.

C. Affix a securely attached plate which includes the manufacturer's name, address, and catalog or serial number to each equipment item. If applicable, include pressure vessels bearing the ASME stamp and pressure rating, indicating compliance with applicable code requirements.

D. Installation Accessories: Provide all rough-in frames, anchors, supports, accessories and closure trim required for complete installation.

E. Use corrosion-resistant materials for all rivets, bolts, nuts, studs, spacers, and welding metal.

F. Fully assemble equipment in factory, except for those items which cannot be moved to their final locations as single item due to new construction space restrictions.

2.03 STERILIZERS

A. Sterilizer: (CFCI) Medium scientific sterilizer.

1. General: High-performance sterilizer (autoclave) specifically designed for sterilizing or decontaminating laboratory items of many sizes and types, with programmable treatment options.
    a. UL listed and/or approved electrical devices and components, bearing NEMA MG 1, IEC or other recognized International ratings, as appropriate for the use intended. Low-voltage DC outputs external to the electrical box.
2. Cabinet Enclosure: Yes.
3. Mounting: On floor, free-standing.
4. Chamber Interior Dimensions: 26 inches wide by 26 inches high by 39 inches front-to-back (660 mm wide by 660 mm high by 991 mm front-to-back).
5. Doors: Number, type, and construction indicated.
6. Operator Controls: Digital type, with touch screen controls and multi-level menus.

7. Control and Monitoring System: Controller, gauges, and wiring.
8. Personnel Safety: Design units to integrate personnel safety features typical to the industry including, but not limited to:
9. Utility Requirements:
    a. Steam: 1 inch NPS FPT (25 mm DN); 50-80 psi (345-551 kPa); 255 pounds per hour (116 kg per hour) maximum flow ,and 148 pounds per hour (67 kg per hour) average flow. Condensate free, and 97 percent to 100 percent vapor quality.
    b. Condensate: 1 inch NPS FPT (25 mm DN).
    c. Hot Water: 1 1/2 inch NPS FPT (40 mm DN); 35 psi (241 kPa); 120-180 degrees F (48.9-82.2 degrees C); 200 gallons per load (757 liters per load) maximum.
    d. Drain Outlet: 2 inch NPS FPT (50 mm DN); 140 degrees F (60 degrees C) maximum; 120 GPM (454 l/min) maximum.
    e. Exhaust: 12 inches (305 mm) diameter; 600 CFM (17 m^3/min); 180 degrees F (82.2 degrees C), saturated.
    f. Compressed Air: 1/2 inch NPS FPT (15 mm DN); 80 psi (551 kPa); 4 CFM (0.11 cubic m/min).

2.04 GLASSWARE WASHERS

A. Glassware Washer: (CFCI) Undercounter capacity.
    1. General: High-performance commercial-quality washer specifically designed for cleaning laboratory glassware of many sizes and types, with programmable treatment options and controlled intake of chemicals.
    2. Cabinet Enclosure: Yes.
    3. Heating: Steam.
    4. Doors: Number, type, and construction indicated.
        a. Number of Doors: One.
        b. Double-pane tempered glass viewing panel.
        c. Gaskets: Manufacturer's standard for type door specified, manufactured to withstand temperatures and pressures generated.
    5. Interior Illumination: Manufacturer’s standard luminaire(s) located on top of the Washer, complete with electronic ballast, gasketed tempered safety glass diffuser, and using fluorescent lamps.
    6. Washing System: Manufacturer's standard, configured for two-level loading and washing, and rinse-water source options.
    7. Operator Controls: Digital type, with touch screen controls and multi-level menus.
    8. Personnel Safety: Integrated personnel safety features typical to the industry.

2.05 ICE MAKERS

A. Ice Maker: (CFCI) Ice machine(s) and storage bin combination unit.
    1. General: High-performance commercial-quality ice machine and storage bin combo specifically designed for making ice of selected sizes and shapes for laboratory use.
    2. Ice Shape: Cubes.
    3. Production: 24-hour volume of 233 pounds (106 kg).

4. Storage Bin Capacity: 370 pounds (168 kg).
5. Condenser Type: Air-cooled.
6. Mounting: Floor-mounted storage bin on legs with levelers, bin-mounted ice machine, with bin adapter.
7. Ice machine:
    a. Front-located air filter.
    b. Anti-microbial agent protection.
    c. Flush cycle operation for sediment removal.
    d. Controls: Digital.
        1) Status Indication: Showing status of critical equipment operation.
        2) Operational Data Handling: Electronic storage and display.
        3) On/off switch.
        4) Ice/drain switch.
        5) Alarm conditions signaling.
8. Utility Requirements Ranges:
    a. Ambient Air Temperatures: 50 to 100 degrees F (10 to 38 degrees C).
    b. Incoming Water Temperature: 40 to 100 degrees F (4.4 to 38 degrees C).
    c. Electrical Voltage Fluctuation: Minus 5 percent to plus 10 percent.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that utility connections, rough-in frames, anchors and supports are accurately placed and deliver building services at specified characteristics and/or within acceptable functional ranges.

B. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with standards required by authority having jurisdiction.

C. Large Components: Ensure that large components can be moved into final position without damage to other construction.

D. Mounting: Anchor equipment securely in place.

1. Mount equipment in compliance with SMACNA (SRM) requirements.

E. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner, and their locations are coordinated with equipment rough-in requirements.

1. Make connections between ferrous and nonferrous metallic pipe with dielectric waterways and flanges having temperature and pressure rating equal to or greater than that specified for the connecting piping. Use dielectric waterways internally lined with an insulator specifically designed to prevent current flow between dissimilar metals.

F. Touch-up minor damaged surfaces caused during installation. Replace damaged components as directed by Architect .

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Provide manufacturer's field representative to inspect all newly installed equipment.

C. Perform functional testing in accordance with referenced specification requirements. Test one item or similar model, as necessary or appropriate, to ensure that it is operational and installation complies with specification requirements.

3.04 ADJUSTING

A. Adjust operating equipment to efficient operation.

3.05 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Demonstrate proper operation of equipment to Owner's designated representative.

D. Demonstration: Demonstrate operation of system to Owner's personnel.

1. Use operation and maintenance data as reference during demonstration.
2. Briefly describe function, operation, and maintenance of each component.

E. Final Acceptance: Remove labels, fingerprints, and clean all surfaces both inside and out. Repair any marred or damaged surfaces that affect appearance, such as both interior and exterior of cabinets in a manner acceptable to Owner. Replace any parts that cannot be repaired in such a manner.

3.06 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

END OF SECTION

SECTION 11 5313
LABORATORY FUME HOODS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Bench-top laboratory fume hoods.
2. Fume hood base stands with countertops.
3. Laboratory cup sinks in fume hoods.
4. Water, laboratory gas, and electrical service fittings in fume hoods.
5. Piping and wiring within fume hoods for service fittings, light fixtures, blower switches, and other electrical devices.

B. Related Sections include the following:

1. Division 12 Section "Wood Laboratory Casework" for laboratory cabinets, including countertops, sinks, and service fittings.
2. Division 23 Sections for fume hood duct connections, including ducts.
3. Division 22 and 26 Sections for installing service fittings in fume hoods, including piping and wiring within fume hoods, and for other wiring in fume hoods, including connecting light fixtures, blower switches, and other electrical devices.
4. Division 22 and 26 Sections for connecting service utilities at back of fume hoods. Piping and wiring within fume hoods are specified in this Section.

1.02 PERFORMANCE REQUIREMENTS

A. Containment: Provide fume hoods that comply with the following when tested according to ASHRAE 110 as modified below at a release rate of 4.0 L/min.:

1. Average Face Velocity: 100 fpm plus or minus 10 percent with sashes fully open.
2. Face Velocity Variation: Not more than 10 percent of average face velocity.
3. Sash Position: Fully open.
    a. Test hoods with horizontal sashes with maximum opening on one side, with maximum opening in the center, and with one opening at each side equal to half of maximum opening.
    b. Test hoods with combination sashes fully raised, with maximum opening on one side, with maximum opening in the center, and with one opening at each side equal to half of maximum opening.
4. As-Manufactured (AM) Rating: AM 0.10.

B. Static-Pressure Loss: Not more than 3/8-inch wg at 100-fpm) face velocity when tested according to Paragraph 6.4.2.4 in SEFA 1.2, "Laboratory Fume Hoods--Recommended Practices."

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For laboratory fume hoods. Include plans, elevations, sections, details, and attachments to other work.

1. Indicate details for anchoring fume hoods to permanent building construction including locations of blocking and other supports.

2. Indicate locations and types of service fittings together with associated service supply connection required.
3. Indicate duct connections, electrical connections, and locations of access panels.
4. Include roughing-in information for mechanical, plumbing, and electrical connections.
5. Show adjacent walls, doors, windows, other building components, laboratory casework, and other laboratory equipment. Indicate clearances from above items.
6. Include coordinated dimensions for laboratory equipment specified in other Sections.

C. Samples for Initial Selection: For factory-applied finishes epoxy sinks.

D. Product Test Reports: Based on evaluation of comprehensive tests according to SEFA 1.2, "Laboratory Fume Hoods--Recommended Practices" and ASHRAE 110 performed by manufacturer and witnessed by a qualified independent testing agency, for fume hoods.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain laboratory fume hoods through one source from a single manufacturer.

B. Product Designations: Drawings indicate sizes and configurations of laboratory casework by referencing designated manufacturer's catalog numbers. Unless modified by notation on Drawings, or otherwise specified, catalog description for designated product constitutes requirements for each product and establishes a standard of design and quality for materials, construction and workmanship. Other acceptable manufacturers' laboratory casework of similar sizes, similar door and drawer configurations, and complying with the Specifications will be accepted.

C. Product Standard: Comply with SEFA 1.2, "Laboratory Fume Hoods--Recommended Practices."

D. Safety Glass: Products complying with testing requirements in 16 CFR 1201 for Category II materials.

1. Subject to compliance with requirements, permanently mark safety glass with certification label of Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Administrative Requirements."

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or other suitable material.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install fume hoods until building is enclosed, wet work and utility roughing-in are complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.07 COORDINATION

A. Coordinate installation of fume hoods with laboratory casework, fume hood exhaust ducts, and plumbing and electrical work.

1.08 EXTRA MATERIALS

A. Furnish complete touchup kit for each type and color of fume hood finish provided. Include fillers, primers, paints, and other materials necessary to perform permanent repairs to damaged fume hood

finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Kewaunee Scientific Corporation, Laboratory Products Group; (Basis-of-Design) Product, Model 48 inch wide Supreme Air LV Fume Hood LV05.
2. Fisher Hamilton L.L.C.
3. Campbell Rhea
4. Labconco Corporation.
5. Collegedale Casework, LLC.

2.02 MATERIALS

A. Steel Sheet: Cold-rolled commercial steel sheet, complying with ASTM A 1008/A 1008M; matte finish; suitable for exposed applications.

B. Glass-Fiber-Reinforced Polyester: Polyester laminate complying with ASTM D 4357, with a chemical-resistant gel coat on the exposed face, and having a flame-spread index of 25 or less per ASTM E 84.

C. Epoxy: Factory molded of modified epoxy-resin formulation with smooth, nonspecular finish.

1. Physical Properties:
   a. Flexural Strength: Not less than 10,000 psi.
   b. Modulus of Elasticity: Not less than 2,000,000 psi.
   c. Hardness (Rockwell M): Not less than 100.
   d. Water Absorption (24 Hours): Not more than 0.02 percent.
   e. Heat Distortion Point: Not less than 260 deg F.
2. Flame-Spread Index: 25 or less per ASTM E 84.
3. Chemical Resistance: Epoxy-resin material has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:
   a. No Effect: Acetic acid (98 percent), acetone, ammonium hydroxide (28 percent), benzene, carbon tetrachloride, dimethyl formamide, ethyl acetate, ethyl alcohol, ethyl ether, methyl alcohol, nitric acid (70 percent), phenol, sulfuric acid (60 percent), and toluene.
   b. Slight Effect: Chromic acid (60 percent) and sodium hydroxide (50 percent).

D. Laminated Safety Glass: ASTM C 1172, Kind LT, Condition A, Type I, Class I, Quality q3 with clear, polyvinyl butyral interlayer.

2.03 CONVENTIONAL FUME HOODS

A. Provide conventional fume hoods without bypass. With sash closed, hood maintains a slight negative pressure to confine fumes.

B. Variable-Air-Volume Control: Equip fume hoods with an electronic control unit with a sensing device that monitors face velocity, and a motorized damper on the exhaust connection that maintains a constant face velocity by controlling air volume in response to control unit. Equip units with manual override switch that opens motorized damper to provide maximum exhaust capacity regardless of sash position.

2.04 FABRICATION

A. General: Preassemble fume hoods in factory to greatest extent possible. Disassemble fume hoods only as necessary for shipping and handling limitations. Fume hoods shall be capable of being partly disassembled as necessary to permit movement through a 35-by-79-inch door opening.

B. Steel Exterior: Fabricate from steel sheet, not less than 0.0478 inch thick, with component parts screwed together to allow removal of end panels, front fascia, and airfoil and to allow access to plumbing lines and service fittings. Apply chemical-resistant finish to interior and exterior surfaces of component parts before assembly.

C. Ends: Fabricate with double-wall end panels without projecting corner posts or other obstructions to interfere with smooth, even airflow. Close area between double walls at front of fume hood and as needed to house sash counterbalance weights, utility lines, and remote-control valves.

D. Interior Lining: Provide the following, unless otherwise indicated:

    1. Glass-fiber-reinforced polyester, not less than 1/4 inch thick.

E. Molded Glass-Fiber-Reinforced Polyester Lining: Molded unit consisting of end panels, back panel, preset rear baffle, and top bonded together into a single piece; reinforced to form a rigid assembly to which exterior is attached.

    1. Punch fume hood lining side panels to receive service fittings and remote controls. Provide removable plug buttons for holes not used for indicated fittings.

F. Exhaust Plenum: Full width of fume hood and with adequate volume to provide uniform airflow from hood, of same material as hood lining, and with duct stub for exhaust connection.

    1. Duct-Stub Material: Epoxy-coated steel, stainless steel, or glass-fiber-reinforced polyester.

G. Sashes: Provide operable sashes of type indicated.

    1. Fabricate from 0.0478-inch- minimum thickness steel sheet, with chemical-resistant finish. Form into four-sided frame with bottom corners welded and finished smooth. Make top member removable for glazing replacement. Set glazing in chemical-resistant, U-shaped gaskets.

    2. Glaze with laminated safety glass, with 3-mm-thick plies.

    3. Counterbalance vertical sliding sash with sash weight and stainless-steel cable system. Provide ball-bearing sheaves, plastic glides in stainless-steel guides, and stainless-steel lift handles. Provide rubber bumpers at top and bottom of each sash unit.

    4. Provide sash opening height of 27 to 30 inches, unless otherwise indicated.

    5. Sash to be self-closing to 18 inches.

H. Provide airfoil at bottom of sash opening to direct airflow across countertop from 1-inch space between airfoil and countertop.

I. Light Fixtures: Provide vaporproof, two-tube, rapid-start, fluorescent light fixtures, of longest practicable length; complete with tubes at each fume hood. Shield tubes from hood interior with 1/4-inch- thick laminated glass or 3-mm-thick tempered glass, sealed into hood with chemical-resistant rubber gaskets. Provide units with fluorescent tubes easily replaceable from outside of fume hood.

    1. Provide fluorescent tubes with color temperature of 3500 K and minimum color-rendering index of 85.

J. Fume Hood Base Stands: Fabricated from 0.0625- and 0.0500-inch-thick furniture grade, cold-rolled steel. Weld frame to form a rigid assembly with pipe chases at one side. The chase end panel is attached with screws and is removable for installation of plumbing and electrical services. Provide a removable enclosure panel at the rear of the base assembly. Finish entire assembly with chemical-resistant finish. Provide leveling device at each corner of base stand at floor.

1. Provide clear floor space not less than required to comply with Americans with Disabilities Act Architectural Guidelines ADAAG.

K. Countertops and Cup Sinks:

1. Resin Countertops: Fabricate with front overhang of 1 inch over base cabinets, continuous drip groove on underside 1/2 inch from edge, and factory cutouts for sinks.

a. Countertop Material: Epoxy composition, uniform throughout full thickness.

2. Cup Sinks: Epoxy, 3-by-6-inch nominal size.

a. Provide with stainless-steel strainers and integral tailpieces.

L. Comply with requirements in Divisions 15 and 16 Sections for installing water and laboratory gas service fittings, piping, electrical devices, and wiring. Install according to Shop Drawings. Securely anchor fittings, piping, and conduit to fume hoods, unless otherwise indicated.

2.05 CHEMICAL-RESISTANT FINISH

A. Preparation: Clean steel surfaces, other than stainless steel, of mill scale, rust, oil, and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it.

B. Chemical-Resistant Finish: Immediately after cleaning and pretreating, apply fume hood manufacturer's standard two-coat, chemical-resistant, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.

1. Chemical and Physical Resistance of Finish System: Finish complies with acceptance levels of cabinet surface finish tests in SEFA 8. Acceptance level for chemical spot test shall be no more than four Level 3 conditions.

2. Colors for Fume Hood Finish: As selected by Architect from manufacturer's full range.

2.06 ACCESSORIES

A. Service Fittings: Comply with requirements in Division 12 Section "Wood Laboratory Casework."

1. Provide service fittings with exposed surfaces, including fittings, escutcheons, and trim, finished with acid- and solvent-resistant, baked-on plastic coating in manufacturer's standard color as approved by Architect.

B. Mobile Flammable Storage Cabinet: Safety cabinet constructed 1-inch, 9-ply high density plywood, finished in standard caution yellow, with “flammable diamonds” on each door and “KEEP FIRE AWAY” in red

C. Airflow Indicator: Provide fume hoods with airflow indicator of the following type:

1. Indicator Type: Direct-reading aneroid (Magnehelic-type) gage that measures fume hood exhaust duct static pressure as an indication of airflow.

2. Indicator Type: Thermal anemometer that measures fume hood face velocity and indicates whether it is below normal, normal, or above normal.

3. Indicator Type: Thermal anemometer that measures fume hood face velocity and displays data as digital readout.

4. Indicator Type: Any indicator type above.

D. Airflow Alarm: Provide fume hoods with audible and visual alarm that activates when airflow sensor reading is outside of preset range.

1. Provide with either thermal-anemometer or aneroid (Magnehelic-type) gage airflow sensor.
2. Provide with reset and test switches.
3. Provide with switch that silences audible alarm and automatically resets when airflow returns to within preset range.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of fume hoods. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install fume hoods according to Shop Drawings and manufacturer's written instructions. Install level, plumb, and true; shim as required, using concealed shims, and securely anchor to building and adjacent laboratory casework. Securely attach access panels, but provide for easy removal and secure reattachment. Where fume hoods abut other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.

B. Comply with requirements in Divisions 15 and 16 Sections for installing water and laboratory gas service fittings, piping, electrical devices, and wiring. Install according to Shop Drawings and manufacturer's written instructions. Securely anchor fittings, piping, and conduit to fume hoods, unless otherwise indicated.

3.03 ADJUSTING AND CLEANING

A. Adjust moving parts for smooth, near silent, accurate sash operation with one hand. Adjust sashes for uniform contact of rubber bumpers. Verify that counterbalances operate without interference.

B. Clean finished surfaces, including both sides of glass; touch up as required; and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

END OF SECTION

SECTION 11 5353
BIOLOGICAL SAFETY CABINETS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Biological Safety Cabinets, Class II, Type A2.

B. Biological Safety Cabinets, Class II, Type B2.

C. Connection to utilities.

1.02 RELATED REQUIREMENTS

A. Section 12 3553.13 - Metal Laboratory Casework for service fittings.

B. Section 22 6005 - Medical Air, Gas, and Vacuum Systems: Laboratory gas connections.

C. Section 23 3300 - Air Duct Accessories: Ductwork connections.

D. Section 26 0583 - Wiring Connections: Electrical connections.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials current edition.

B. NEMA MG 1 - Motors and Generators 2017.

C. NSF 49 - Biosafety Cabinetry: Design, Construction, Performance, and Field Certification 2016.

D. SEFA 2 - Installations 2010.

E. SEFA 8M - Laboratory Grade Metal Casework 2016.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Show complete construction details, fittings, electrical connection, filters and other information necessary to fully describe each unit and its installation. Include plans and elevations. Include CFM and static pressure requirements. Indicate required installation, operational, and maintenance clearances to wall and ceilings.

1. Submit coordination drawings for cabinets which interface via canopy hood, canopy exhaust (thimble) connection assembly, or are hard-connected to the building's exhaust system.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer's Installation Instructions: Indicate special installation requirements.

E. Installer's Qualification Statement.

F. Operation Data: Include description of equipment operation and required adjusting and testing.

G. Maintenance Data: Identify maintenance requirements, servicing cycles, recertification requirements, and local spare part sources.

H. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

I. Project Record Documents: Record actual locations of concealed utility connections.

J. Field Reports: Start-up report(s) prepared by independent qualified certifier, accredited by NSF to test and balance biological safety cabinets.

K. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:

1. See Section 01 6000 - Product Requirements, for additional provisions.

2. Furnish complete touchup kit for each type and color biological safety cabinet finish provided. Include fillers, primers, paints and other materials necessary to perform permanent repairs to any damaged biological safety cabinets' finishes.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience and approved by manufacturer.

C. Structural Performance: Provide cabinet components capable of withstanding the following loads without permanent deformation, excessive deflection, or binding of cabinet walls and viewscreen:

1. Channel Base Stands: 50 pounds per foot (74 kg/m) plus weight of cabinet, complying with SEFA 8M requirements.

D. Safety Glass: Comply with testing requirements of 16 CFR 1201 for Category II materials.

E. Preinstallation Conference: Conduct at project site with manufacturer’s representative present to confirm site is prepared for acceptance of equipment.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package each piece of equipment to ensure protection from damage during shipment and delivery.

B. Protect finished surfaces during handling and installation with protective covering of polyethylene film or another suitable material.

1.08 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install biological safety cabinets until building is enclosed, wet work and utility roughing-in is complete, gypsum board, spackling, painting, flooring installation is completed, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE/DESIGN CRITERIA

A. Design meeting requirements of the particular class and type of cabinet.

1. Class II Type A2: Suitable for testing and experimentation with low to moderate risk biological agents and (when connected by canopy "thimble" connection to HVAC) treated with minute quantities of toxic chemicals and trace quantities of radionuclide that will not interfere with the work if recirculated in the downflow air.

2. Class II Type B2: Suitable for testing and experimentation with low to moderate risk biological agents may be used for work with volatile toxic chemicals and radionuclide required as part of

microbiological research.

2.02 BIOLOGICAL SAFETY CABINETS - CLASS II, TYPE A2

A. General: Enclosed, ventilated cabinet designed to offer personnel, product and/or environmental protection, while limiting cross-contamination between biological agents inside the cabinet and in surrounding environment.

B. Biological Safety Cabinet Classification: Class II, Type A2.

C. Performance Specifications: NSF 49.

D. Nominal Size: 6 foot (1.8 m).

E. Cabinet Style: Benchtop/Console with base stand.

F. Work Zone: Provide minimum dimensions complying with performance specifications of specified unit.

1. Width: 70-3/8 inches (1788 mm).
2. Height: 60-7/8 inches (1546 mm).
3. Front-to-Back (Measured at 10 inches (254 mm) Window Height): 28-1/2 inches (724 mm).

G. Front View Window Opening Height: Fully-closed to 21 inches (533 mm) high opening.

H. Work Access Opening Height:

1. Biological Safety Cabinet: 8 inches (203 mm).

I. Controls: Microprocessor-based control system with cleanable membrane touch-screen control panel mounted on the front of the cabinet and facing down towards operator while seated.

1. Audible alarm and flashing LED to indicate unsafe condition.
2. Alarm mute switch on the front of the cabinet to allow a brief time for equipment loading in the work zone. Automatic reactivation of audible alarm after five minutes if the viewscreen sash remains at the improper height. The visible alarm to stay on until safe conditions are reestablished.
3. Delay-Off Timer: For lights, outlets and optional ultraviolet lights. Capable of 15-minute interval settings.

J. Illumination: Externally-mounted fluorescent lighting fixture with solid state ballasts producing an average of 100 footcandles (1076 lux) at work surface.

K. Filters: One supply and one exhaust, scan-tested, zero-probe HEPA Filter, 99.99 percent efficient on 0.3 micron particles by DOP test, serviceable and removable from front of unit. Exhaust filter also accessible from top of unit. Air balancing damper in filter housing with external control.

L. Electrical Requirements: Dedicated 115V, 20 amp, 60 Hz single phase circuit required. Pre-wired cabinet with a 14 foot (4.27 m) power cord terminated with a NEMA 5-20P plug.

M. Electrical Receptacles: GFCI duplex receptacles in the work area protected by an independent self-resetting breaker.

1. Configuration: Flush-mounted with slow-closing cover.
2. Number of Receptacles: One.

N. Bulkhead Fittings: Connectors with easily and cleanly removable and reusable elastomeric seals. Penetrations using applied sealants are not permitted. Seal standard blank-out plugged penetrations for future fittings gas-tight.

O. Gaskets: Manufacturer's standard closed cell Neoprene, forming airtight seals to suit installation conditions and cabinet function.

P. Drain Pan: Unitized pan with radius corners on all sides to facilitate cleaning. Removable work surface and supports facilitating cleaning of the drain pan. Stainless ball valve at drain outlet.

Q. Cable Port: Through negative pressure sidewalls to allow passage of tubes or cables, with design meeting Class 100 (ISO Class 5) air cleanliness immediately inside opening in the work area (as verified by a particle counter).

R. Ergonomic Armrest: Flow-through bypass armrest fitted over airfoil, with a closed cell neoprene pad for operator comfort.

S. Service fittings and fixtures, including escutcheons and trim, on left sidewall inside the work area. Provide two fitting locations per each side of cabinet.

T. Standard Accessories:

1. One stainless steel ball valve from drain pan located in knee space on left side.
2. Airflow Indicator: Magnehelic.

2.03 BIOLOGICAL SAFETY CABINETS - CLASS II, TYPE B2

A. General: Enclosed, ventilated cabinet designed to offer personnel, product and environmental protection, while limiting cross-contamination between biological agents inside the cabinet and in surrounding environment. May be used for work with volatile toxic chemicals and radionuclide required as adjunct to microbiological studies.

1. 100 percent exhausted from cabinet to building exterior.

B. Biological Safety Cabinet, Classification: Class II, Type B2.

C. Performance Specifications: NSF 49.

D. Nominal Size: 6 foot (1.8 m).

E. Cabinet Style: Benchtop/Console with base stand.

F. Work Zone: Minimum dimensions complying with performance specifications for unit specified.

1. Width: 70-3/8 inches (1788 mm).
2. Height: 25-3/16 inches (640 mm).
3. Front-to-back (measured at 10 inches (254 mm) Window Height: 26 inches (660 mm).

G. Front View Window Opening Height: Fully-closed to 18-1/2 inches (470 mm) high opening.

H. Work Access Opening Height:

1. Biological Safety Cabinet,: 8 inches (203 mm).

I. Controls: Microprocessor based control system with cleanable membrane touch-screen control panel mounted on the front of the cabinet and facing down towards operator while seated.

1. Alarm mute switch on the front of the cabinet to allow a brief time for equipment loading in the work zone. Automatic reactivation of audible alarm after five minutes if the viewscreen sash remains at the improper height. The visible alarm to stay on until safe conditions are reestablished.
2. Delay-Off Timer: For lights, outlets and optional ultraviolet lights. Capable of 15-minute interval settings.

J. Illumination: Externally-mounted fluorescent lighting fixture with solid state ballasts producing an average of 100 footcandles (1076 lux) at work surface, with a minimum of 90 footcandles (968 lux).

K. Electrical Requirements - Dedicated 115V, 20 amp, 60 Hz single phase circuit required. Pre-wired cabinet with a 14 foot (4.27 m) power cord terminated with a NEMA 5-20P plug. Two GFCI outlets in the

work area protected by an independent self-resetting breaker.

L. Cable Port: Through negative pressure sidewalls to allow passage of tubes or cables, with design meeting Class 100 (ISO Class 5) air cleanliness immediately inside opening in the work area (as verified by a particle counter).

M. Ergonomic Armrest: Manufacturer's standard flow-through bypass armrest fitted over airfoil, with a closed cell neoprene pad for operator comfort.

N. Service fittings and fixtures, including escutcheons and trim, on left sidewall inside the work area.

1. As specified in 12 3553.13 - Metal Laboratory Casework.

O. Standard Accessories:

1. One stainless steel ball valve from drain pan located in knee space on left side.

2. Airflow Indicator: Magnehelic.

2.04 FABRICATION

A. General: Assemble each biological safety cabinet in factory to greatest extent possible. Disassemble cabinets only as necessary for shipping and handling limitations, or as necessary to permit movement through a 35 inches by 79 inches (889 by 2007 mm) clear door opening.

B. Cabinet Construction: Double-wall construction, with negative pressure airflow between the walls from drain pan to top surrounding sides and back of work area. High-velocity return air slots in side walls and top adjacent to front access opening for enhanced containment and reduction of air turbulence.

C. Cabinet Assembly: Welded, gasketed and/or hermetically sealed joints for cabinet components, capable of achieving a soap-bubble-tested seal when completely assembled.

D. Cabinet Exterior: 16 gage, 0.063 inches (1.52 mm), cold rolled steel, with baked enamel white finish.

1. Component parts bolted or screwed together to allow removal of end panels and front fascia.

E. Cabinet Interior: One piece, fully-welded 16 gage, 0.063 inches (1.59 mm) stainless-steel sheet, type 304, no.4 finish, side walls and rear walls with radiused rounded corners. Perforated metal diffuser top of work zone, protecting supply filter.

F. Front View Window: Vertical sliding, frameless, with 1/4 inch (6 mm) thick laminated safety glass at a 10 degree angle from the vertical.

G. Airfoil: Aerodynamic design at bottom of access opening, directing airflow into front grille.

H. Gaskets: Manufacturer's standard closed cell Neoprene, forming airtight and soap-bubble-tight seals to suit installation conditions and cabinet function.

I. Work Surface: Removable dished work surface tray with integral supports.

J. Drain Pan: Unitized pan with radiused corners on every side to facilitate cleaning, with a minimum liquid holding capacity of 1 gal (3.79 L). Stainless ball valve at pan drain outlet.

K. Motor-Blower: Complying with NEMA MG 1; Variable speed, constant airflow 3/4 horsepower ECM motor with VFD controller. Position within BSC unit to promote even filter loading.

L. Supply Air Plenum: Telescoping design air plenum of steel construction with acid-resistant finish. HEPA filters to be front loading, directly clamped, uniformly loaded, and sealed by closed-cell neoprene gaskets.

M. Air Diffuser and Filter Protector: Stainless steel assembly on top of the cabinet.

N. Filters: One supply and one exhaust, scan-tested, zero-probe HEPA Filters, 99.99 percent efficient on 0.3 micron particles by DOP test, serviceable and removable from front of unit.

1. Type A2 Cabinets: Exhaust filter also accessible from top of unit.
2. Type B2 Cabinets: Exhaust filter located below.

O. Exhaust Plenum: All steel construction, with acid-resistant finish. Size for adequate volume to provide unidirectional airflow from cabinet.

1. Type A2 Cabinets:
    a. Duct-Stub: 10 inch (254 mm) diameter. Steel, with powder-coated finish, in manufacturer's standard color.
2. Type B2 Cabinets:
    a. Exhaust Transition Collar: 12 inch (305 mm) diameter. Type 304 stainless steel, with manufacturer's standard finish.

P. Sashes: Front view window guides incorporating a counterweighted pulley system allowing up and down movement, with one-hand low-effort operation.

1. Glass edges covered with metal extruded channel.
2. Glaze with laminated safety glass.
3. Guide rails capable of holding the sash in place regardless of position.
4. Rubber bumpers to cushion sash when fully opened or closed.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of biological safety cabinets.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install biological safety cabinets in compliance with shop drawings and manufacturer's written instructions.

B. For ducted (canopy and hard-connected) exhaust installations, set cabinet stand at the appropriate height in compliance with coordination drawings.

C. Large Components: Ensure that large components can be moved into final position without damage to other construction.

D. Comply with indicated requirements for installing laboratory gas service fittings, and electrical devices.

1. Install fittings in compliance with installation requirements in SEFA 2.

E. Connect to facility utilities.

1. Coordinate laboratory gas connections with work of section 22 6005.
2. Coordinate ductwork connections with work of section 23 3300.
3. Coordinate electrical connections with work of section 26 0583.

3.03 FIELD QUALITY CONTROL

A. Owner will employ independent testing agency to test and/or inspect installed biological safety cabinets; provide access and assistance as required to accommodate timely performance of testing.

3.04 ADJUSTING

A. Adjust moving parts for smooth, near silent, accurate sash operation with one hand. Verify that counterbalances operate without interference.

3.05 CLEANING

A. Clean finished surfaces, including both sides of glass; touch up as required; and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

B. Clean adjacent construction and surfaces that may have been soiled or damaged in the course of installation of work in this section.

C. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

3.06 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Training: Train Owner's personnel on operation and maintenance of system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

2. Provide minimum of two hours of training.

END OF SECTION

SECTION 11 6140
STAGE CURTAINS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 and Division 26 Specification sections, apply to work of this section.

1.02 GOVERNING CLAUSE

A. For the sake of brevity these specifications shall omit phrases such as "Contractor shall furnish and install", "unless otherwise indicated or specified", etc., but these phrases are nevertheless implied. Mention of materials and operations requires the Contractor to furnish and install such materials and perform such operations completely to the satisfaction of the Owner.

1.03 SCOPE OF WORK

A. One company shall be responsible for the installation or coordination of the installation of all aspects of the stage equipment. Work under this section shall include the furnishing of all labor, materials, tools, transportation services, supervision, etc., necessary to complete installation of new stage equipment as well as any other items as herein listed, all as described in these specifications, as illustrated on the accompanying drawings; or as directed by the Architect or his Representative.

B. Work specifically included in this section for the Auditorium and Black Box Theatre:

1. Motorized Rigging
2. Dead Hung Rigging
3. Stage Curtains & Tracks
4. Lighting System Circuit raceways on Flying Battens

C. Work related but not included in this section

1. Structural steel, gridiron, structural support steel, in wall blocking
2. Galleries, ladders, catwalks, railing
3. Stage flooring
4. Electrical connections, disconnect and service equipment, Conduit, Boxes, Wiring
5. Division 26 – Electrical contractor installation of theatre electrical equipment.

1.04 CONTRACTOR’S QUALIFICATIONS:

A. The Contractor shall be fully experienced in the fabrication and installation of the stage equipment as specified.

B. The Contractor shall have been in business for ten (10) full years preceding the date of this bid doing work similar to the type specified and under the same name.

C. The Contractor shall employ only fully trained stage riggers and mechanics for the erection of the stage equipment.

D. The contractor shall employ a full time project manager who shall be available for multiple field site visits for coordination with other trades as required by the project General Contractor at no additional cost to the project.

E. The stage riggers shall be completely familiar with the type of equipment to be installed. A competent Job Superintendent shall be on the job at all times when work is in progress.

F. The Stage equipment contractor shall have a qualified person on staff that has successfully completed OSHA 500/501 training.

G. The Stage Equipment contractor must be able to provide Bid, Payment, and Performance bonds if required.

1.05 SUBSTITUTIONS:

A. See section 01 60 00 for requirements.

B. It has been determined that these are the particular items establish a standard of quality, equipment function and/or process.

1.06 DEFECTIVE OR NON-APPROVED MATERIALS

A. Should any stage equipment be found defective, not meeting specifications, or that which has not been approved in writing by the Owner shall, upon discovery (including any time within the period of the guarantee), be replaced with the specified equipment or material at no additional cost.

1.07 GUARANTEE

A. The Contractor shall guarantee all of the work that is performed under this contract, including all materials, and workmanship, for a period of one (1) year from the date of full acceptance of the work.

B. Lamps for lighting fixtures shall be guaranteed against failure for thirty (30) days.

C. Nothing in this guarantee shall cause repair or replacement by the Contractor where negligence, neglect or improper operation by the Owner has caused the failure of any equipment installed under this contract.

1.08 DISCREPANCIES

A. All equipment shall be sized to fit properly. The exact measurements are the responsibility of the Contractor. If there are discrepancies in the specifications, the Contractor shall ask for a clarification from the Owner. If no clarification is requested, the Owner's judgment shall rule.

1.09 PRE-APPROVED STAGE EQUIPMENT CONTRACTORS

A. One company shall be responsible for the installation of all aspects of the stage equipment as specified in this section. This shall include but not be limited to all rigging, curtains, tracks, motors and control, stage lighting fixtures, stage/house dimming, and dimming controls and miscellaneous equipment. The Stage Equipment Contractor shall be an approved manufacture or an authorized dealer of an approved manufacture.

B. The following companies have prior approval as STAGE EQUIPMENT CONTRACTORS:

1. Texas Scenic Company, Inc., San Antonio, Texas. – Mid Atlantic Office, 611A Lofstrand Lane Rockville MD, 20850 Phone: 301-309-1490, Fax: 301-309-1492

2. Pook Diemont & Ohl – 701 East 132nd st. Bronx NY 10454 Phone: 718-402-2677 Fax:718-402-2859

3. The Specialty Group, LuXout Stage Curtains, 1221 Admiral Street, Richmond, VA 23220, Office 800-817-1204; www.luxout.com.

4. Others approved by addendum:

a. In order to be considered as a Stage Equipment Contractor on this project, each Contractor requesting approval must submit to the Architect, prior to the date of bid opening, a letter expressing his intent to bid. This letter shall include a list of at least five (5) projects of similar size and scope completed by this firm within the last five (5) years. Included with this letter shall be a brief written description of the contractors operation including facilities, financial capabilities, and experience of key personnel. If motorized line-shaft rigging is required on this

project, the letter shall indicate the number of line-shaft set provided and installed and the manufacturer of the equipment on each of the five projects. Inspection of one completed installation may be requested by the Architect/Architect's Representative prior to consideration of request to bid. Companies, which have no experience in the installation and operation of line-shaft rigging, will not be considered. The stage equipment contractor shall have been in business under the same name for ten (10) full years preceding the date of this bid doing work similar to the type specified. The decision of the Architect as to the capability of the Bidder to successfully complete and maintain the system, based on this pre-qualification information shall be final.

b. Sale representatives of manufacturers and Jobbers are not considered stage equipment contractors & shall not be approved to bid this project.

c. Stage Equipment Contractor shall employ a full time project manager who shall be assigned to the this project and shall provide onsite coordation as necessary. The project manager shall live and be based within 100 miles of the project site. IF requested the Stage Equipment contractor shall provide the name, resume, and pertinete qualification for his work on the project.

d. Pre-Bid request letter shall include a statement that all major items of equipment shall be bid and supplied as specified, or shall contain details of all proposed substitute equipment for review by the Architect/Architect's Representative. Substitute equipment items to include specifications, parts numbers, and details of interconnection to proposed system. The decision of the Architect/Architect's Consultant as to the acceptability of substitute equipment shall be final.

e. The Stage Equipment Contractor shall employ only fully trained stage riggers and mechanics, assisted by common laborers, for the erection of the stage equipment. The stage riggers shall be completely familiar with the type of equipment to be installed. A competent Job Superintendent shall be on the job at all times when work is in progress. He shall represent the Stage Equipment Contractor and all directions given by him shall be as binding as if given by the Stage Equipment Contractor.

1.10 DOCUMENTATION

A. Shop Drawings: Shop drawings and equipment data sheets shall be submitted in accordance with Section 01 30 00. If shop drawings are rejected, correct and resubmit in the manner as specified. All shop drawing information shall be submitted at the same time; no partial submittal will be accepted. Drawings shall indicate complete details, dimensions, product types and locations of all equipment, clearances required, guides, cables, sets, Contractor fabricated equipment, and all other details required to completely describe the work to be performed. Submittals drawings shall be presented at a scale of not less than 1/8" = 1'-0" for conduit plans, 1/4" for equipment layouts, ½" = 1'-0" for mounting details, and ½" = 1'-0" for plate and panel details. Each sheet to allow space for approval stamps and have the name of the project, the contractors and/or the supplier's name, address telephone number, and the date submitted. Submit the following items for Owner's approval, prior to fabrication:

1. Stage plan view.
2. Stage side section view.
3. Gridiron layout indicating all stage equipment.
4. Electrical riser diagrams indicating the necessary control wiring for all dimming, distribution, and controls wire tag number for every connection. Show all terminal blocks with wire numbers and location.
5. Plan and elevation views indicating all electrical hardware locations and layout.

6. Provide full dimensions for panel layouts with finishes and materials for all custom panels.
7. Provide details of installation and erection, including adjoining conditions and necessary clearances.
8. Indication by arrow and boxed caption of each variation from contract drawing and specifications, except those indicated as acceptable in specifications or on drawings

B. Fabric Samples: Submit sample books of each fabric specified, containing standard colors available in the quality of the material specified for selection of color and approval. More than one color may be selected. After selection, upon request, submit one square foot samples of each material in each color for final review.

C. Record Drawings and Data: Submit in accordance with General Provisions. Also within 30 days of final test and completion of the installation, submit the following to the Owner:

1. Three (3) complete sets of "as built and approved" drawings (rolled, not folded) showing systems and elements as installed, including field modifications and adjustments.
2. Three (3) sets of maintenance data including a list indicating replacement parts lists for all items of equipment, wiring diagrams, control diagrams, any and all keys for cabinets, racks, key operated switches etc. and complete operation manuals.
3. Three (3) notarized Certificates of Flameproofing for each fabric used.
4. Three (3) Certificates of Guarantee

D. Instruction of Owner Personnel:

1. This contractor or his representative, fully knowledgeable and qualified in systems operation, shall provide eight (8) total hours of instruction to the Owner-designated personnel on the use and operation of this System in 2 sessions.
2. Designated instruction times shall be arranged through the Owner.
3. Training shall be recorded on video and 2 copies shall be saved to DVD and turned over to Owner.

E. Permits: Obtain all permits necessary for the execution of any work pertaining to the installation, and conform in all trades with all applicable local codes and with the National Electric Code. Obtain all permits necessary for operation of any equipment by the Owner.

F. Clean Up: It shall be the responsibility of this Contractor to remove all debris from the building or site caused by his operations to a common trash point or receptacle on the job site, as determined by the Owner.

PART 2 - PRODUCTS

2.01 ACCEPTABLE RIGGING EQUIPMENT MANUFACTURERS

A. For the purposes of establishing a standard of quality desired on this project, the rigging hardware products of H & H Specialties, Inc. of South El Monte, California are specified. Other stage equipment hardware with prior approval for bidding shall be any and all companies (not an individual) that are contributing members or sustaining members in good standing with United States Institute of Theatre Technology (USITT) at the time of the bid will be considered. Specific items of hardware by any approved manufacturer must still meet the criteria established in these specifications for those items. The rigging hardware products of other manufactures who are not members of USITT may not be used in the construction of this project.

B. Manufacturers whose equipment has prior approval to be used on this project include the following companies:

1. Texas Scenic Company, Inc.

2. Electronic Theatre Controls
3. H&H Specialties
4. SSRC inc

C. All other companies must receive prior approval to bid this project. Please refer to the section regarding substitutions.

2.02 ACCEPTABLE DIMMING/CONTROL EQUIPMENT MANUFACTURERS

A. Specified herein shall be the sole responsibility of a single manufacturer who shall fabricate all assemblies and major sub-assemblies in his own shops. The manufacturer shall have been producing theatrical lighting and SCR control equipment for at least five consecutive years. Specific hardware and item of equipment are specified by trade names as it has been determined by the Owner that these particular items establish a standard of quality, equipment function and/or process which is desired. It is neither the purpose nor intent of these documents to eliminate competitive bids. A contractor may submit his bid based on equipment different from that specified only if that Contractor has received prior approval in writing from the Owner. In order that they have sufficient time to evaluate the proposed deviation from specification, all requests of this nature shall be in the Owner’s office no less than ten (10) working days prior to the bid date. The following manufacturers are considered approved for use on this project. This approval is only based on the model/catalog numbers, series or type detailed herein for each item.

1. Dimming & Controls: Strand Lighting, Electronic Theatre Controls, Inc.
2. Distribution: SSRC, Inc. Electronic Theatre Controls Inc.
3. Lighting Fixtures:
    a. Ellipsoidal: Electronic Theatre Controls, Inc., Altman Lighting
    b. Pars: Electronic Theatre Controls, Inc.
    c. Fresnel: Electronic Theatre Controls, Inc., Strand Lighting
    d. Work lights: SSRC, Inc.,
    e. Cyc Lights: Altman Stage Lighting, Electronic Theatre Controls
    f. Followspot: Lycian, Strong Lighting

B. Listing as Acceptable manufacture does not allow companies to provide substitution of equipment that do not performe to specifcations or meet requirments of equipment as set forth this bid document.

C. All other companies must receive prior approval to bid this project. Please refer to the section regarding substitutions.

2.03 THEATRICAL RIGGING EQUIPMENT

A. General Standards:

1. Paint as required under this section shall be the manufacturer's standard finish and color except as noted.
2. All equipment items shall be new and conform to applicable provisions of Underwriters' Laboratories and American Standards Association.
3. Where acceptable equipment items are specified by catalog number only, device shall meet all published manufacturer's specifications. Where quantities are not given, refer to drawings. Where two or more products are listed, contractor may use either, at his discretion. Equipment shall not be substituted without specific written approval by the Architect/Architect's Representative under the substitution paragraphs of these specifications.

B. General Rigging Standards:

1. All pipe battens shall be fabricated from 1.5" schedule 40 pipe.
2. All turnbuckles, clips, tracks, chains and other items of incidental hardware shall be furnished plated or painted. Wire rope shall be galvanized. Fasteners, chain, and other miscellaneous hardware shall be either cadmium or zinc plated.
3. All materials used in this project shall be new, unused and of the latest design. Refurbished materials are not permitted.
4. In order to establish minimum standards of safety, a minimum factor of 8 shall be used for all equipment and hardware used on this project. In addition, the following factors shall be used:
    a. Cables and fittings: 8 Safety Factor.
    b. Cable bending ratio: 30 times diameter.
    c. fleet angle: 1 ½ degrees.
    d. Steel: 1/5 of yield.
    e. Bearings: Two times required load at full for 2000 hours.

2.04 MOTORIZED RIGGING REQUIREMENTS

A. General

1. Furnish and install Motorized Lineshaft winches, both fixed and variable speed, to raise and lower the stage battens as specified herein.
2. The batten shall travel from a low trim of 4’-0” above stage floor to approximately 1’-0” below the winch assemble.
3. Each batten winch shall operate at a fixed speed
4. Each lineshaft winch shall have drums alternately grooved for right and left hand winding to prevent the batten from traveling.
5. Drums shall be supported on each side with a flange block assembly.
6. Miscellaneous hardware such as battens, cable, etc. shall follow USITT standards and specifications.
7. Motorized lineshaft assembly shall have integral continuous frame, running parallel to the driveshaft, designed to support and align each drum and drum housing. Systems not using an integral frame to align and support the lineshaft assembly shall not be acceptable.
8. Electrical installation of motor starter & control panel by division 26
9. Bidders proposing alternate motorized rigging systems will bear the cost of additional engineering and steel structure necessary for systems that produce horizontal and lateral loading to the infrastructure or require additional mounting beams. Bidders will be required to provide engineered drawings Stamped by a Maryland PE detailing their proposed system and its impact on the structure.

2.05 PRODIGY LOW PROFILE HOIST

A. General:

1. Prodigy Low Profile Hoist shall be purpose-designed and fabricated for overhead lifting of theatre lights, curtains and scenic elements. The systems shall incorporate mechanical, electrical and safety features that shall be inherent to this equipment and shall provide an engineered, efficient device for overhead lifting. The mechanical, electrical and safety features of this hoisting and control

system shall establish the standard of quality, performance and safety by which hoisting systems of other manufacture shall be evaluated.

2. Each wire rope liftline shall adhere to a design factor of 10:1 with an ultimate strength of 4200 pounds. All load path components between the building structure and the batten shall exceed the breaking strength of the wire rope. The motor brake shall be rated at least at 150% of the motor torque.
3. The standard configured P1500E hoist shall be capable of lifting up to 1500 pounds suspended below the connector strip and pipe batten. The standard configured P1300G hoist shall be capable of lift up to 1300 pounds suspended from the pipe batten.
4. The standard hoist shall consist of the following major components: 1) powerhead, 2) compression tube with beam clamps, cable management system, loft blocks, lift line and lift line terminations and 3) pipe batten and power/control distribution strip.
5. The hoist shall include the following features:
    a. A powerhead containing the gearmotor, motor brake, load brake, limit switches operating electronics, load sensor, slack line detector and wire rope.
    b. The powerhead shall be no larger than 18” wide x 14” high x 55” long.
    c. The powerhead shall weigh no more than 400 pounds.
    d. A compression tube structure shall prevent any lateral forces from transferring to the building. Hoists or hoisting systems that impose a lateral load on the building structure shall not be acceptable for this project.
    e. The hoist shall incorporate a built-in load cell.
    f. The hoist shall incorporate a built-in slack line sensor.
    g. The hoist shall incorporate the emergency contactor.
6. The hoist shall be manufactured from UL Listed components and shall be UL Listed and tested as a complete system (not just UL listed parts).

B. Powerhead:

1. The powerhead shall be a fully enclosed sheet metal housing which shall prevent contact with moving and electrical parts and shall provide protection against dirt, dust and debris collecting on the operating parts of the machine, the electrical and electronic components and the wire rope lift lines on the lifting drum.
2. The powerhead housing shall be fabricated from powder coated sheet metal. It shall be punched and formed to enclose and support the gearmotor, motor brake, load brake, limit switch assembly, limit switch adjustment system, reversing contactor, emergency contactor, wire rope drum, wire rope (cable) keeper, load cell, slack line detector and motor electronics.
3. The rear hinged cover of the powerhead shall support connectors, switches and LED lights for the following functions: local operating switch, power and control connector outlets, indicator lights for operating mode, limit switch indicator, limit switch override button, indicators for power, status and communication. Each of these functions shall be clearly labeled to identify their purpose.

C. Gearmotor and Motor Brake: The gearmotor and motor brake shall be an integral unit from a single manufacturer. It shall produce 2 horsepower and shall operate on 208 volt, 60 Hz, 3 phase power.

1. The gearmotor shall operate the hoist at a fixed speed yielding a line speed averaging 30 feet per minute.

2. The gearmotor shall drive a monolithic double output shaft that extends from each side of the gearbox through the support bearings without couplings.
3. The integral motor brake shall be spring applied and electrically released.
4. The brake shall be capable of holding 150% of the motor full load torque.
5. On one side of the gearbox, the Prodigy Hybrid Drum™ shall be mounted. Up to eight 3/16” dia. 7 x 19 wire ropes, ASTM Specification 81023/A1023M-02, commonly referred to as galvanized aircraft cable, shall be wrapped on that drum.
6. The portion of the shaft protruding from the opposite side of the gearbox shall support the load brake.

D. Load Brake: The rotary disk load brake shall bring the moving load to a complete stop and shall hold the load in position in the event of a mechanical failure of the motor, motor brake or gearbox.
1. The load brake shall not generate noise at any time in the operational cycle.
2. At no time shall normal hoist operation be limited by heat or noise caused by the load brake.
3. When lowering the load the Load Brake shall partially disengage to allow movement. In the absence of rotational torque on the gearbox, the load brake will not release.

E. Wire Rope Drum: The Prodigy Hybrid Drum™ shall allows the lift lines to be wrapped in a compact manner that prevents wire rope damage.
1. A wire rope shall not cross over other wire ropes, nor lie vertically on top of another wire rope nor be allowed to stack in a single pile as on a yoyo drum.
2. The drum shall have been tested for wear, durability, strength, service and integrity by an independent testing lab.
3. The sloped drum shall be capable of safely wrapping up to eight pieces of 3/16” diameter wire rope lift lines.
4. An assembly of wire rope (cable) keepers shall assure that the lift lines wrap appropriately on the drum.

F. Limit Switch: The limit switch assembly shall be mounted within the powerhead. The limit switch shall establish hard “normal” end of travel limits and hard “ultimate” end of travel limits for movement in either direction. In addition, software shall establish resettable “normal up” and “normal down” end of travel limits, typically redundant for the normal end of travel limits. This combination of hard limits and soft limits shall provide each hoist with a total of three “up” and three “down” limits to assure that the hoist does not exceed the maximum allowable travel in either direction.
1. The hard end of travel limits shall be set or adjusted at the time of installation via a screw adjustment on the bottom/rear of the powerhead cover.
2. An indicator light shall be visible on the bottom panel of the powerhead cover and shall illuminate when the setting screw is adjusted to the current position of the batten.
3. Any system that indicates that the limit has been set by audible or tactile means only shall not be acceptable.

G. Load Sensor/Load Profiling:
1. A load sensor shall be built into the powerhead. It shall be possible to create a profile of the actual load on the hoist as it travels through its normal cycle. The profile may be changed by “re-training” the profiling system whenever the suspended load is changed on the batten by activating a key-switch operated training cycle. The load sensor shall continuously monitor the load.

H. Slack Line Detector:

1. The slack line detector shall be built into the hoist. When a slack line condition develops, the slack line detector shall remove power from the hoist and prevent hoist movement.

I. Cable Management:

1. The load circuits and control wiring shall be fed to the hoist by a built-in cable management system that allows the flat feeder cable to fold and store along the top of the connector strip.
2. At high trim, the entire system shall be store in no more than 30” of vertical space.
3. The cable management system shall be integral to the hoist system.
4. Hoisting systems utilizing cable management systems from third-party vendors shall not be acceptable for this installation.

J. Compression Tube and Beam Clamps:

1. The compression tube shall be a continuous channel of extruded aluminum engineered to neutralize the horizontal forces on the building.
2. The tube shall support the loftblocks mounted within the spacing limits of the system.
3. Compression tube sections shall be joined into a continuous assembly by dedicated splicing plates at each tube joint.
4. The tube shall be installed only by means of dedicated beam clamps that allow the compression tube to snap into place.
5. Beam clamps shall be capable of attaching to horizontal beams, joist flanges or flat steel plates measuring from 3/8” thick up to 1” thick and from 4” wide up to 14” wide.
6. Hoist systems that do not neutralize the lateral forces on the building shall not be accepted for this project.

K. Loft Blocks:

1. Each loft block shall be an assembly of steel side plates, a wire rope idler, sheave and support hardware. Each loft block shall be inserted into a slot on the bottom of the compression tube. The blocks shall be positioned in the compression tube within 6’-0” of a beam clamp, and no closer than 3’-0” from each other
2. Loft blocks shall measure 5” in diameter and contain a pair of press fit sealed ball bearings. Lift lines shall travel in a groove shaped and sized for 3/16” diameter wire rope per the latest edition of the Wire Rope Users’ Manual as published by the Wire Rope Technical Board. The loft block sheave shall be concentric about the hub and shall be evenly balanced for ease of rotation.
3. An idler shall be incorporated into the top assembly of the loft block to guide and support lift lines as they pass the block.
4. Hoisting systems requiring the loft blocks to be mounted directly to the facility steel shall not be accepted for this project.

L. Hangers:

1. Raceway hangers shall be specially shaped flat bar that shall support the wire rope termination hardware and secure the raceway and the pipe batten.

M. Liftline Terminations:

1. Each lift line shall be terminated at the powerhead via a standard thimble and a copper oval compression sleeves installed at the factory.

2. Liftlines shall be terminated at the load hanger with a low profile Right Angle Cable Adjuster (RACA)™, thimble and copper oval compression sleeve. The RACA and cable terminations shall be installed at the time of hoist installation.
3. The batten trim shall be adjusted up to 6” at the RACA.
4. Systems utilizing turnbuckles or chain to trim the batten shall not be accepted for this installation.

N. Connector Strip - Distro:

1. Power to the connector strip shall be fed via UL listed flat cable especially designed and fabricated for this system.
2. The flat cable shall be UL listed. The flat cable shall provide one ground and one data cable plus an individual hot and an individual neutral for each of six 120 volt circuits.
3. The strip shall be built to the length specified with outlets or pigtails located as specified or shown on the construction drawings.
4. Flat feed wire shall enter a terminal box at the designated end of the raceway. The wiring and all components shall meet UL requirements and NEC codes, as appropriate.

O. Pipe Batten:

1. The pipe batten shall be I ½” (nom.) schedule 40 grade A, seamless pipe fabricated in the largest possible lengths without splices, typically 21’-0” long. Battens of greater length shall be spliced by means of .120 x 1 9/16 dia DOM tube 18” long with 9” of tube inserted into each half of the splice. The tight fitting splice tube shall be held in place by a pair of 3/8 x 2 ½” grade 5 hex bolts on each side of the joint. The bolts shall pass through the pipe at an angle of 90° to each other. There shall be two bolts on each side of the joint spaced 1” and 8” from the joint. Alternatively, one pair of bolts on one side of the joint may be replaced with either plug welds or tight fitting rivets. Pipes shall be straight and painted flat black.
2. A safety-yellow batten cap shall be installed at each end of each pipe batten.

P. Power and Control Distribution:

1. Each hoist shall receive power and control via a pair of 8’-0” long jumper cables extending from the powerhead to the source outlets. The receptacles shall be installed in a sheet metal junction box located less than 8’-0” away from each hoist powerhead and shall include a power and control outlet. Inclusion of a 20 amp 3 phase breaker in the distribution box is optional. The wiring and connectors shall be barriered between high and low voltage. The power/distribution channel shall be UL listed for this application.

2.06 QUICKTOUCH CONTROL SYSTEM

A. General:

1. The entire hoisting system shall be operated by a Quicktouch Group 8 fixed speed controller. It shall be purpose-designed and fabricated to manage and operate hoists specifically designed for overhead lifting of theatre lights, curtains and scenic elements. The systems shall incorporate mechanical, electrical and safety features that shall be inherent to this equipment and shall provide an engineered, efficient device to control the equipment. The mechanical, electrical and safety features of this control system shall establish the standard of quality, performance and safety by which hoisting systems of other manufacture shall be evaluated.
2. The Quicktouch Control System shall consist of a surface or flush mounted primary control panel and up to three remote E-stop stations. The hoisting system shall also include one Quicktouch Fixed Speed Remote control device with 35’ of flexible cable that may be attached to the system at the primary operating station, the Quicktouch Group 8 control panel.

3. The controller shall include the following features:
    a. Key operated power switch
    b. LCD display with feedback/operating information
    c. Key operated hoist load profile training/enable switch
    d. Latching hoist selection buttons with rear illuminated naming tabs
    e. Rear illuminated hold-to-operate (deadman) up and down operation buttons
    f. Dedicated E-stop button
    g. Outlet for wired remote
    h. Optional door
    i. Optional rack mount kit
4. The controller shall be UL Listed and shall be fabricated from UL Listed components.

B. Enclosure:
1. The back box and face panel shall be fabricated from 16ga powder coated sheet steel specially formed to provide support for installation as well as all components installed within the housing.
2. The Quicktouch face panel shall be printed with complete labeling information to identify the function each of the buttons in the control station.
3. The face panel shall identify the system as a Quicktouch controller for stage rigging.
4. The face panel shall be shades of grey. The ring surrounding the E-stop button shall be safety yellow and shall be rear illuminated
5. The face panel shall be removable. The steel panel to which all switches are mounted shall be removable via screws in the surface located underneath the face panel.

C. LCD Screen:
1. The liquid crystal display shall be purpose designed to communicate all information in human readable text.
2. The screen shall be rear illuminated.
3. During system start up the screen shall show the progress of the hoists diagnostics self tests. Upon completion of the start up sequence the screen shall indicate that the system is “OK” or shall provide specific information should a fault be detected. Fault conditions shall be reported in human readable text. System that report fault conditions in a series of blinking lights shall not be acceptable for this installation.
4. When a hoist is selected the LCD screen shall readout the hoist name or number, its current position above the floor, the amount of weight suspended from the batten, preset position recorded, as well as a bar graph scale that shows the current position of the hoist, top and bottom limits and the current weight suspended by the hoist.

D. Hoist Selection/Operation Buttons:
1. There shall be 8 rear illuminated hoist selection buttons. When the button is selected it shall be rear illuminated. The button shall remain illuminated until it is de-selected.
2. Up to four hoists may be selected to move at one time. When the up or down button is pushed and held each hoists shall move to its next stop location. If the stop location is the adjustable preset, the hoist can be made to continue to travel in the selected direction by releasing and re-pressing the up or down hold-to-operate button until the next stop for the hoist(s) is reached.

3. Only four hoists may move at one time and they may only move in one direction at a time.
4. All buttons shall fit neatly within each of the metal and cover panel cutouts on the controller.

E. Key Switches:

1. A key switch shall control power to the control system. The key must be in the lock and the key turned to the on position for the hoisting system to operate.
2. A separate key is required to turn on the load profiling system. That key must be in the lock and turned to the “ON” position for load profiling to be functional.
3. When load profiling is turned on the hoist will know the amount of weight that is supposed to be supported by the batten at any location in the path of travel. Should the weight exceed or be reduced below the profiled weight, the hoist will stop operation until the fault is cleared.

F. Slack Line Detector:

1. The slack line detector is located in the power head. When a slack line condition occurs, power will be disconnected from the hoist and the hoist will cease to operate until the slack line condition has been cleared. The condition will result in a fault message on the LCD screen on the controller.

G. E-Stop:

1. The E-stop button on the Quicktouch controller shall be a mushroom button with a rear illuminated ring surrounding the button. The light shall always be on. During normal operation the E-stop button shall be in the out position. An E-stop can be activated via this button by firmly pressing the button in. the button will latch and will immediately cause a class zero stop of all hoists in the system. The LCD screen shall report the E-stop as an E-stop fault. To continue system operation the E-stop button must be cleared by twisting the button to release the latch.
2. Up to three remote E-stop stations may be connected to the system. Each remote E-stop station shall operate in the same way as the primary E-stop at the Quicktouch control panel.

H. System Diagnostics:

1. Upon energization the control system shall perform a series of diagnostic tests that shall assure that all system safety functions are working. Should an error in the safety functions be determined the controller shall report back a fault condition in the LCD display window and shall identify the nature of the fault.
2. Monthly, the system shall perform an additional series of diagnostic tests to determine if there are any problems with any portion of the hoisting control system safety features. In the event of a problem, the controller shall report back a fault condition in the LCD display window and shall identify the nature of the fault.
3. 11 months after a system inspection has been performed , system will remind the user to schedule full system maintenance/inspection. The reminder will remain in the system until it is turned off by the factory authorized and trained inspector.

I. Remote Control Pendant:

1. An optional remote control pendant with 35’-0” long attached cable and plug shall be provided for the system. The remote control must be plugged to the Quicktouch control panel. When the remote control is plugged in the E-stop on the remote is active.
2. The remote control provides up/down control for those hoists that have been preselected at the Quicktouch controller.

J. Support Cables And Fittings

1. All support cables unless otherwise noted shall be 7 x 19 construction, galvanized aircraft cable with a breaking strength of 7000 lbs.
2. Damaged of deformed cable shall not be used.
3. Cable fittings and clips shall conform to wire rope manufacturer's recommendations as to size, number, and method of installation.
4. Clips shall be drop forged "Crosby" or "Malleable".
5. There shall be two cable clips for each lift line tie-off.
6. Pressed sleeve fittings shall be Nicopress Copper sleeves.
7. Eyes shall be formed over wire rope thimbles of correct sizes.
8. All wire rope rigging shall be installed so as to prevent abrasion or rubbing of the wire rope against any part of the building construction or other equipment; pulleys and sheaves shall be so aligned as to provide a maximum fleet angle of two degrees; mule blocks, cable rollers, guides and sag bars shall be installed as required to provide proper alignment.

K. Trim Chains

1. Trim chains shall be 1/4" grade 30 proof coil chains 30" long with a 1/4" screw pin anchor shackle on one end.
2. The threaded connector shall be rated at not less than 800 lbs. capacity and shall have the rating stamped on each unit.
3. Trim chains shall be installed on batten end of each support line.

L. Pipe Battens

1. Pipe battens shall be 1-1/2" in diameter schedule 40 pipe.
2. All battens shall be painted black to prevent rusting.
3. Where splicing is required, a pin, 18" long and the same diameter as the inside diameter as the pipe shall be used. This pin shall be held in place with no less than four 3/8 hex bolts and lock nuts. Pins or rivets shot into pipe shall not be acceptable.
4. Mark the center of each batten with a 1” wide yellow stripe
5. Paint the last 3’0” of each end of each pipe batten yellow.

M. Provide Motorized Rigging Set per drawings, consisting of (but not limited to) the following:

1. Capacity: As noted in drawings.
2. Speed: 20 fpm.
3. Batten Travel: 45 feet.
4. Drum Diameter: 8 inches.
5. Cable Size: 3/16 inch.
6. Number of Drums: Eight.
7. Type of Limit Switches: 4 Pos Overtravel.

2.07 DEAD HUNG RIGGING

A. Support chains:

1. Support chains shall be 3/16” electro galvanized grade 30 proof coil chain.

2. Chain shall be attached to overhead building structures or bridging steel using ¼” forged screw pin anchor shackle and rated beam clamp
3. Chains shall be attached to pipe battens with one and one half wrap around batten and attached back with to the chain with a ¼” forged screw pin anchor shackle.
4. Provide and install a 3/8” diameter safety bolt, one Nylock nut, and two flat washers per trim chain after batten is leveled
5. Each hanging point shall include enough additional chain to lower the batten 3 feet below the scheduled trim

B. Pipe Battens:

1. Pipe battens shall be 1-1/2" in diameter schedule 40 pipe.
2. All battens shall be painted black to prevent rusting.
3. Where splicing is required, a pin, 18" long and the same diameter as the inside diameter as the pipe shall be used. This pin shall be held in place with no less than four 3/8 hex bolts and lock nuts. Pins or rivets shot into pipe shall not be acceptable.
4. Mark the center of each batten with a 1” wide yellow stripe
5. Paint the last 3’0” of each end of each pipe batten yellow.

C. Provide the following:

1. Dead hung rigging battens for scenery and curtain tracks as detailed on theatrical rigging layout drawings.

2.08 RIGGING SCHEDULE

A. Provide and install in types and quantities as detailed on drawings.

2.09 PIPE GRID

A. Provide stationary 41’ x 44’ pipe grid where indicated on the drawings.

1. Pipe grid spacing is to be 4'-0" by 4'-0" on center and installed 18’-0” off the finished floor.
2. Grid pipe is to be 1-1/2" schedule 40 pipe painted black. Where splices are required, provide sleeve of the same diameter as the inside of the pipe, minimum 18" long. The sleeve will be held in place by four (4) bolts.
3. Hanger spacing will not exceed 8'-0" and each pipe will be supported by a hanger at least 2'-0" from the end of each pipe. Each hanger will be constructed from 3/8" all thread rod and power strut #3200-1-1/2" pipe hanger. Each hanger will be designed for a 300 pound load with a 5 to 1 safety factor. All beam clamps are to have a safety anchor and shall be B-Line #B3690-1-1/2” pipe hanger or equal.
4. Grid brackets will be required at each joint where the sections of 1-1/2" pipe cross around the perimeter of the grid and at every other junction on the interior. Brackets are to be #308 1-1/2' by 1-1/2" grid brackets or Roto Lock by Upright Scaffolding.
5. The entire grid will be attached to the vertical side walls in at minimum three equal points on each side of the grid by extending the pipe to the side wall and attaching it to a wall flange. The mounting shall be rigid and in such a way as to secure the entire grid from movement.

2.10 CURTAIN AND SCENERY TRACKS

A. Tracks shall be by H&H Specialties of South El Monte, California. Manufacturer's recommendations on installation of all tracks and related hardware shall be followed. Automatic Devices Inc. of Allentown, PA

shall be considered equal.

B. Track for the Front Curtain shall be H&H Model #400 Steel Track in two (2) unbroken unspliced sections, complete with all necessary accessories for rope operation including #416 neoprene tired carriers, #418 master carriers, #433 6" double end pulley, #434 6" single end pulley, 1/8” rubber bumpers, rear fold guides and #438 floor pulley. Use only pipe brackets and # to secure tracks to battens.

C. Track for the Mid-Stage Curtain shall be the same as specified for the Front Curtain.

D. Track for the Rear Curtain shall be the same as specified for the Front Curtain.

E. Track for the Legs #1, shall be H&H Model #318 walk along track curved as shown in drawings to provide necessary sightlines

F. Track for the Legs #2, shall be H&H Model #418 walk along track in six (2) - 16' long sections complete with all necessary hardware.

G. Track for Rear Cyc Curtain shall be H&H Model # 428 walk along track in single 75’ section

2.11 STAGE CURTAINS

A. Fabrics:

1. Main Curtain, Valance: Provide 25oz. Prestige IFR Velour material as manufactured KM Fabrics, Greenville, South Carolina. Color to be selected by Architect from manufacturers full range.

2. Rear setting curtains: Provide 16oz. Plateau IFR Velour material as manufactured KM Fabrics, Greenville, South Carolina. Color to be selected by Architect from manufacturers full range.

3. All Stage Curtains: Provide 25 ounce Prestige or 16 ounce Plateau (as specifically indicated in curtain schedule), Inherently Flame Retardant Velour (54" width) as manufactured by KM Fabrics, Greenville, and South Carolina. 25 ounce Lyceum Velour from Dazian's, New York, New York, is an acceptable substitute. Color to be selected by Architect from manufacturers full range.

4. Sky Cyclorama: 24'-6" width, seamless flame proofed white muslin and cut down to appropriate size as indicated in bid documents. As supplied by Frankel and Associates of New York, New York or Rose Brand of New York, New York.

B. Flamproofing:

1. Fabrics used in fabrication of draperies shall be chemically flameproof with a formula approved Bureau of Standards U.S. Department of Commerce, and finished fabric, after treatment, shall pass such tests as are required by the Fire Marshall of the local Fire Dept. and Owner.

2. A certificate for each type and color of cloth used shall be furnished to the Owner when request for final payment is made.

3. Certificate shall state name of Stage Equipment Contractor, name of firm doing flameproofing treatment, date of treatment, date re-treatment will be required, method of treatment, and the certificate shall be affixed the signature of an officer or authorized representative of the firm furnishing the draperies.

4. The information on certificate shall be notarized by a Notary Public in the State of Maryland.

C. Fabrication of Standard Stage Draperies:

1. Sew fabrics with box-pleats to 3-1/2" wide heavy-duty upholstery IFR webbing, pleats spaced 12" on centers, unless otherwise specified. Use mercerized cotton thread, minimum weight #16; color to match cloth shall be full length and shall be without splices for entire length of the curtain.

2. Properly join panels smooth and free of puckering at seams, hems, and turnbacks.

3. Where completed curtains are to be operated on a traveler track, equip each pleat with a 2" plated harness snaphook mounted to curtain by means of a strap of web-belting to curtain by riveting with not less than 2 tubular rivets per snaphook. Web-belting straps shall pass over front and back sides of pleats, and rivets shall go completely through the web-belting, jute webbing, and all thickness of curtain fabric. Canvas straps, leather straps, grommets and s-hooks, cotter key hooks, etc., shall not be acceptable.
4. Where completed curtains are to be tied to a pipe batten, each pleat shall be equipped with a 30" long #4 braided nylon tie line through a No. 2, or larger brass grommet, each to be on 12" centers located in the box pleats at the webbing.
5. Bottom hems of all curtains shall be 5" and shall be equipped with a separate canvas pocket sewn inside bottom hems in such manner as to have the bottom of the canvas pocket at least 1-1/2" above bottom of curtain hem. Load canvas pocket with #6 galvanized pump chain, secured to prevent bunching and shifting within the pocket.
6. Off-stage vertical hems and center-facing turnbacks of the front curtain and mid-stage shall be one-half width (27") of material faced back and no sewn hem shall be permitted within these hems. Vertical hems of all masking borders, travelers, and cyclorama curtains shall be 6".
7. Finish curtains properly in the best manner and method of the industry, and after hanging, thoroughly brush to remove dust, visible dirt, loose threads, loose fabric lint, etc. Wrinkles shall be allowed to fall our naturally.
8. Fullness desired for each panel of curtains is indicated by the number of widths specified for each item. Any number of widths less than the number specified will result in re-fabrication of curtains.

D. Fabrication of Sky Drop and Scrim Curtains:

1. Across the top of each unit the fabric shall sewn flat to a 3-1/2" webbing double stitched with #16 mercerize cotton thread.
2. Provide 2" plated harness snaphook on 12” centers mounted to curtain by means of a strap of web-belting to curtain by riveting with not less than 2 tubular rivets per snaphook. Web-belting straps shall pass over front and back sides of pleats, and rivets shall go completely through the web-belting, jute webbing, and all thickness of curtain fabric. Canvas straps, leather straps, grommets and s-hooks, cotter key hooks, etc., shall not be acceptable.
3. Bottom hems of walk along track mounted cyc and scrims shall be equipped with a separate canvas pocket sewn inside bottom hems in such manner as to have the bottom of the canvas pocket at least 1-1/2" above bottom of curtain hem. Load canvas pocket with #6 galvanized pump chain, secured to prevent bunching and shifting within the pocket.
4. In addition to chain pocket for Walk along cyc and scrim in the bottom hem, sew in a canvas pipe pocket large enough to accommodate a 1" pipe. Provide bottom 3/4" rigid conduit in 10' sections with threaded couplings for joints.
5. Side hems shall be 3" wide double folded double stitched hems.

2.12 STAGE CURTAIN SCHEDULE:

A. Note- Contractor responsible for field verification of all curtains dimensions prior to construction.

CURTAIN	FABRIC	SIZE	FULLNESS	INSTALLATION
Valence	25 oz. Velour	1 panel: 59' W x 8' H	75% Added	On Pipe Batten
Front Curtain	25 oz. Velour	2 panels: 36' W x 21' H	75% Added	On Specified Track
Legs #1, 2, 3	16 oz. Velour	6 panels:	50% Added	On Specified

		14' W x 21' H		Track
Borders #1, 2, 3, 4	16 oz. Velour	4 panels: 69' W x 6' H	50% Added	On Pipe Batten
Mid Stage Traveler	16 oz. Velour	2 panels: 36' W x 21' H	50% Added	On Specified Track
Rear Traveler	16 oz. Velour	2 panels: 36' W x 21' H	50% Added	On Specified Track
Cyclorama	Seamless White Muslin	69' W x 24' H	One Seamless Width	On Specified Track
BB Cyc	25 oz. Velour	4 panels: 20' W x 18' H	50% Added	On Specified Track

2.13 STAGE DIMMING AND CONTROL SYSTEM

A. Electrical requirements of the Stage Equipment Contractor: The Stage Equipment Contractor shall be responsible for providing to the electrical contractor all stage lighting and dimming hardware as specifically detailed in these specifications. This shall include:

1. Furnishing all equipment specified.
2. Hanging of connector strips on specified stage rigging hardware.
3. Set-up of the control console.
4. Demonstration of equipment to owner's representatives.
5. Lamping & Hanging all stage lighting fixtures.
6. Low Voltage Specialty Control wire
7. All low voltage lighting control terminations.

B. The Stage Equipment Contractor shall coordinate with the Electrical Contractor to provide the following:

1. Any conduit.
2. Any wiring.
3. Power requirements and termination of same in dimmer rack.
4. Any load wiring, fixtures, or termination at fixtures for house lighting or emergency lighting.
5. Mounting of plugboxes, floor pockets, back boxes and gridiron junction boxes (locations to be coordinated with stage equipment contractor).

C. Factory Check-Out: This contract shall also include the services of a qualified engineer regularly employed by the manufacturer of the system that shall check the installation and ensure its proper operation. No part of the system shall be energized before being so checked and the installation approved.

2.14 DIMMING AND CONTROL SYSTEM

A. Electrical requirements of the Stage Equipment Contractor: The Stage Equipment Contractor shall be responsible for all stage lighting and dimming hardware as specifically detailed in these specifications. This shall include:

1. Furnishing all equipment specified (some to be given to Electrical Contractor for installation)
2. Hanging of connector strips and pantographs on specified stage rigging hardware.
3. Set-up of the control console.
4. Demonstration of equipment to owner's representatives.

B. The Stage Equipment Contractor shall not be responsible for the following:
   1. Any conduit
   2. Any wiring
   3. Power requirements and termination of same in dimmer rack
   4. Any load wiring, fixtures, or termination at fixtures for house lighting or emergency lighting
   5. Mounting of plugboxes, floor pockets, back boxes and gridiron junction boxes (locations to be coordinated with stage equipment contractor)

C. FACTORY CHECK-OUT: This contract shall also include the services of a qualified engineer regularly employed by the manufacturer of the system that shall check the installation and ensure its proper operation. No part of the system shall be energized before being so checked and the installation approved.

2.15 DIMMER RACKS

A. The installation rack shall be the Sensor as manufactured by Electronic Theatre Controls, Inc., or equal. The fully digital dimmer rack shall consist of up to 48 dimmer module spaces. Sensor rack systems shall be UL Listed and CSA Approved, and shall be so labeled when delivered to job site.

B. The dimmer rack shall be provided with wired spaces for all circuits. Dimmers shall be provided for all base circuits and blank modules provided for all expansion circuits. Provide base circuits indicated in bill of materials.

C. The dimmer racks shall house all dimmer modules, control electronics, and branch circuit breakers. Provide module and breaker quantities as indicated below. System shall have the performance features that follow.
   1. Rack shall be UL Listed and labeled.
   2. Rack shall employ dead front construction of code gage steel.
   3. Each rack must have a hinged locking door.
   4. Each rack must have an electrostatic air filter.
   5. Ventilation shall be by a low-noise fan activated by DMX level data.
   6. In the event of an over-temperature situation, each dimmer shall be shut down independently as required. Systems that shut the entire rack down upon over-temp will not be accepted.
   7. Each 48-module dimmer rack shall be provided with a keypad and LCD display for rack configuration, backup and fault indication.
   8. Each rack shall maintain active scene for a user-programmable period after loss of DMX-512 signal from console.
   9. Standard control format shall be USITT DMX-512. Dimmer rack CEM must accept two independent DMX signals concurrently in a highest-takes-precedence manner for each dimmer.
   10. Rack shall store a minimum of thirty-two user-programmable back-up looks which may be activated in case of loss of control signal.
   11. Each dimmer must include discrete "boost" feature to allow over-voltage output to compensate for voltage drop in branch wiring and allow a true 120 volts at the fixture lamp or “trim” maximum voltage output to lengthen lamp life.
   12. Each rack shall include a beacon which shall flash to indicate failures.

2.16 DIMMER MODULES

A. Dimmer modules shall be plug-in type. No more than two dimmers per module will be accepted.

B. Modules shall be assembled of aluminum or steel. Dimmer modules with housings manufactured of plastic or a flammable material will not be accepted.

C. Each dimmer module shall contain fully magnetic circuit breakers(s), solid state switching module(s), choke(s) and connectors.

D. Each dimmer must have the discreet capability to operate in a dimmed or a non-dimmed mode. This function shall be selectable from the control console or the rack-mounted keypad.

E. Each dimmer circuit shall use solid state switching devices consisting of two silicon controlled rectifiers in an inverse parallel configuration, snubber network and all required gating circuitry on the high voltage side of an integral opto-coupled control voltage isolator.

F. Dimmer modules shall include toroidal filters to reduce lamp filament sing and limit the radio frequency interference on line and load conductors. The current rise-time shall be not less than 500 microseconds measured at 90 degree conduction angle from 10-90% of the output wave-form with the dimmer operating at rated load.

G. Power efficiency shall be at least 97% at full load.

H. Dimmer shall accept hot-patching of an incandescent load up to the full capacity of the dimmer.

I. Dimmer output shall be regulated for incoming line voltage variations, except that the output voltage cannot be increased above a level equal to line voltage less dimmer insertion drop. Line regulation shall be +/- 1V over a 90-140 volt range for changes up to 10%. Load regulation shall be +/- 2V for 1-100% of rated current. Dimmers shall employ a scheme for compensation for harmonic distortion of the power line for any variation in load.

J. Response to control shall be less than 25 milliseconds.

2.17 CONTROL ELECTRONICS

A. General:

1. The dimmer rack electronics shall be contained in one plug-in Control Electronics Module (CEM+). Each CEM+ shall plug into a dimming cabinet, with no discrete wire connections. A simple User interface shall be provided for system configuration, testing and diagnostics. There shall only be one model for all rack types.

B. Electronics:

1. The CEM+ shall be provided with an Ethernet control signal input. This input shall be fully configurable with a range of patching and priority programming capabilities.

2. Two optically isolated DMX512 inputs shall also be provided, allowing overlapping or separation of any control level. 2,500V of optical isolation shall be provided between the DMX512 inputs and the CEM+. This shall protect the DMX512 inputs from a failed control module and the CEM+ from failed DMX512 inputs. Systems that do not have optical isolation on a prewired factory plug-in device shall not be acceptable.

3. The CEM+ shall be completely digital, without employing any digital-to-analog de-multiplexing schemes or analog ramping circuits.

4. In the event of data loss each rack shall maintain the last level for a user programmable time of zero to five minutes or indefinitely, or may be programmed to fade to and play an emergency preset. Systems that do not offer this feature shall not be acceptable.

5. The CEM+ shall respond to control changes in less than 25 milliseconds. Dimmer outputs shall exhibit no oscillating or hunting for levels. Dimmers set to the same level shall output within ±1V of

each other, regardless of phase or electronic module control.

6. Dimmer output shall be regulated for incoming line voltages. The regulation shall adjust for both RMS voltage changes and deformations in the incoming AC waveform. The CEM+ shall monitor and adjust each dimmer's output to maintain a constant power to the load. Regulation shall maintain the desired output voltage ±1V for the entire operating range (90-140V AC) with the exception that the maximum output will be no greater than the line voltage minus dimmer insulation loss. The regulation shall compensate for dips and anomalies in the AC waveform on a dimmer-by-dimmer basis. There shall be no interaction between dimmers in the system or any other equipment. The output shall be nominally regulated to 120V, but shall be field adjustable on a dimmer-by-dimmer basis to allow for varying cable length.
7. The entire response to incoming line changes shall take no more than 25 milliseconds. Dimming systems that do not respond to line fluctuations and do not contain wave deformation detection shall not be acceptable.
8. The CEM+ shall contain diagnostic routines to allow the user to test and troubleshoot the system. The CEM+ shall contain a Test/Bypass switch to turn all dimmers on to full for testing. This switch shall bypass all electronics and shall force the fan on.
9. A system wide panic circuit shall be provided. Any dimmer in any rack may be assigned to the panic circuit.
10. The CEM+ shall be able to record up to 128 backup looks. Backup looks shall be programmable by recording current dimmer levels (as set by the console), by entering dimmer levels on the CEM+ directly, or a combination of both methods. When a backup look is active, the DMX512 inputs shall be ignored in the default priority mode.
11. All system functions may be activated by the CEM+'s user interface and shall not require any remote unit. Systems that do not offer this feature shall not be acceptable.
12. The CEM+ shall be able to configure dimmers for ETC Dimmer Doubling, which allows a single dimmer to set two different levels on one dimmer circuit by splitting the AC power into positive and negative halves.

C. User Interface:

1. A backlit 6-button keypad and 2-line-by-20-character backlit LCD shall be provided for system configuration, testing and diagnostics. The backlit design of the panel controls shall provide for ease of use in dark environments.
2. The six buttons shall be Accept, Back, Plus, Minus, Home and Test.
3. The front panel shall have four status LED indicators: a blue LED for power status and three green LEDs for Network, DMX A, and DMX B status.
4. A reset switch shall also be located on the front of the unit.
5. Menu functions:
    a. DMXA/B or EDMX data may be assigned sequentially from a starting control channel (base addressing) or patched per control channel to any dimmer via the user interface.
    b. The dimmer curve shall be capable of being set on a per-channel basis. The default curve shall be the IES modified square law. Additional curves include: Square Law, Linear, and Sensor v2.0. The CEM+ shall also have the capability of storing up to three custom curves and shall have an adjustable Preheat, all assignable on a per dimmer basis.
    c. The dimmer mode shall also be capable of being set on a per-channel basis. Modes shall include: Normal, Dimmer Doubled, Switched (unregulated on/off with adjustable threshold), or

Fluorescent with adjustable threshold.

d. DMX Loss behavior can be set to either Hold Last look, Wait and Fade, or Fade to Preset.

e. Up to 128 presets may be programmed, recording any level, whether set in direct level menu or by a Data input. Presets shall be activated in the default fade time of 2 seconds.

f. The direct level menu shall provide the ability to set a dimmer or groups of dimmers to a level.

6. The CEM+ shall be capable of monitoring and displaying [LCD] incoming line voltage for all three phases. With installed current sensors the same display shall show amperage on each phase. This display shall not timeout.

7. English, French, German and Spanish language support shall be built in.

8. The CEM+ shall contain the following user displays:

a. Status display to show rack identification and errors. Error Messages shall include, but not be limited to, the following:

b. Dimmer has shut down due to over temperature

c. DMX port A or B has an error or has failed

d. Phase A, B or C is below 90 volts

e. Phase A, B or C is above 140 volts

f. Rack has shut down due to air flow loss

g. Ambient temperature is below 0°C/32°F

h. Ambient temperature is above 40°C/104°F

9. Rack has shut down - ambient temperature exceeds 46°C/115°F

10. Ability to program and activate system-wide backup looks from face panel or web User Interface.

11. About display shall allow monitoring of system, rack or dimmer status.

a. About System shall provide information about Panic circuits, Preset looks, and System name.

b. About Network shall provide IP address, gateway and net mask.

c. About Rack General shall provide information about rack name, ambient temperature, air filters and rack type.

d. About Rack Power shall provide information about power type, rack voltages, current per phase (only with current transformers), under voltage warnings.

e. About Rack Data shall provide status for DMXA, DMXB, EDMX and Network activity.

f. About Dimmer shall provide information about dimmer type, location, output level, control source, scale voltage, mode and curve.

12. Setup display shall allow but not be limited to, configuring of rack addresses, dimmer firing mode, and scale voltage values.

D. Dimmer Status Network:

1. The Dimmer Status network shall provide remote monitoring, programming and backup functions for the system through any Sensor compatible console, PC, or hand-held remote device. System information shall also be displayed on any system interface including the CEM+ and the devices listed above. Systems that do not provide both types of user interface shall not be acceptable.

2. Dimmer Status network shall provide an integral link to connect all racks in the system for rack-to-rack communication. Information for all configuration and backup looks shall be stored in all CEM+'s to allow swapping of CEM+'s throughout the system. Systems not storing all configuration data and backup looks for each dimmer in all control modules shall not be acceptable.
3. A technician shall be able to program all parameters onsite, using a laptop personal computer. These parameters shall include, but not be limited to, defining rack type, module type, scale voltage for each dimmer, firing mode, curve, dimmer numbering and DMX512 port assignments. Systems requiring factory programming shall not be acceptable.

E. Advanced Features:

1. Sensor's Advanced Features (AF) option shall add an additional sensor in the individual dimmer modules. The AF option shall allow monitoring of current and output voltage on a dimmer-by-dimmer basis and provide information on lamp burnouts, dimmer status, and input voltages.
2. The CEM+ shall allow the user to record the loads of all AF dimmers in the system. The CEM+ shall, during operation, test each AF dimmer, determine its load, and compare it to the recorded load. Any change from recorded loads greater than five percent shall display an error on the CEM+ and any monitoring device on the ETCLink network.

F. Physical:

1. Dimmer control electronics shall be contained in one plug-in Control Electronics Module, housed in a formed steel body with an injection molded face panel.
2. An airflow sensor shall be provided. In the event of inadequate airflow, the affected rack shall shut down until the error is corrected.
3. If the ambient room temperature drops below 0°C/32°F or rises above 40°C/104°F, a warning shall appear on the dimmer rack LCD. If the temperature rises above 46°C/115°F, the rack shall shut down until the condition is corrected.
4. Dimmer control electronics module shall operate at up to 120/208V, three phase, four wire + ground, 47 to 63 Hz. The CEM+ shall automatically compensate for frequency variations during operation.

2.18 CONTROL CONSOLE- AUDITORIUM

A. General:

1. The lighting control console shall be a microprocessor-based system specifically designed to provide complete control of stage, studio, and entertainment lighting systems. The console shall be the Ion as manufactured by Electronic Theatre Controls, Inc., or equal.
2. The control system shall be Net3 and ETCNet 2 native, with both protocols output simultaneously over the network. The system shall also be able to control third party ACN devices directly. The system shall provide control of 1000 outputs/channels, 1500 outputs/channels or 2000 outputs/channels.
3. A maximum of 10,000 cues, 99 cue lists, 1000 groups, 1000 presets, 4 x 1000 palettes (Intensity, Focus, Color and Beam), 1000 effects, 1000 macros and 99 curves may be contained in non-volatile electronic memory and stored to an onboard hard disk or to any USB storage device.
4. The console may be placed in Tracking or Cue Only mode by the user as a system default and overridden on individual record actions as required.
5. A Master Playback fader pair and dedicated Grand Master/Blackout shall be provided.

6. Up to six USB fader wings may be connected to the console, for a maximum of 240 submasters and or 30 playback faders, with six pages of control. USB fader wings may be rigidly connected to the main console to provide a "single connected unit" with no external cables required. The wings also may be connected via USB cables and used "on the side."
7. A high-resolution level wheel shall be provided to control intensity for selected channels and scrolling within selected displays. Four page-able high-resolution encoders shall be provided for control of other non-intensity parameters. Non-intensity parameters shall be controllable via the encoders or keypad controls, without need of an external pointing device.
8. Rotary encoders for non-intensity parameters shall be labeled by means of an integral LCD display mounted above or below the encoders on the main console. The display shall show the currently loaded functions of the encoders based on the current selections. Systems using encoders with no LCD labeling shall not be acceptable.
9. Control and programming features for automated fixtures shall also include: a standard library of fixture profiles, the ability to edit existing profiles and create new profiles, patch displays including channel and output addressing, 16-bit fade resolution, color characterization allowing color mixing and storing in Hue and Saturation or native device values.
10. System information, including playback status, live output and blind values for all record targets shall be displayed on a maximum of two external high resolution DVI monitors, or one SVGA monitor, which may also be touch-screen(s). Only one display shall be required for operation.
11. The system shall direct user input through on-screen dynamic prompts and integral LEDs on console keys indicating current operating mode. A context sensitive on-line Help feature shall explain and provide an example of the operation of each feature of the system.
12. An optional, fully-functioning, detachable alphanumeric keyboard shall be provided. The keyboard shall allow labeling of channels, cues, presets, groups, palettes, effects, macros, curves and the show. An integral electronic keyboard shall be provided.
13. A row of soft keys shall be provided, which change function based on the selection and context of the console. These soft keys shall be labeled via an adjacent LCD display that shows their current functions at all times. Systems using soft keys with no LCD display shall not be acceptable.
14. Console software upgrades shall be made by the user via a USB port; changing internal components shall not be required.
15. The console operating software shall be loaded into program execution memory from the internal hard drive when the console is powered. In the event of an uncontrolled shutdown, the console shall return to its last output state when power is restored.
16. Show data may be created and modified on a personal computer, using an offline editing application.
17. A PC running a client software application shall be able to connect to a control system via the network and view or modify current show data in an independent display environment. Additional devices on the network shall also be able to act as clients to the main console.
18. Synchronized backup shall be provided via another full console on the network or by use of a remote processor unit. The backup unit (either full console or rack mounted Remote Processor Unit (RPU)) shall maintain synchronized playback with the master and shall take over control of the lighting system upon loss of communication with the master. Use of two RPUs to service and backup system output is also supported. Systems that do not offer this kind of instant backup from multiple sources shall not be acceptable.

19. A maximum of four users may access and interact with show data simultaneously. Each user shall have an individual workspace.
20. The system shall allow remote control from external devices as follows: Client software running on a PC connected to the network, a remote video interface with keyboard, a purpose-built wireless remote focus unit (Radio Focus Remote). Universal fader wings may be attached to any of these devices for local fader control. Systems without these remote control devices shall not be acceptable.
21. The system shall support a Telephone remote control that allows basic functions to be controlled from a standard wireless phone producing touch-tone signals. This allows the use of a standard telephone for a low cost remote control. Systems that do not allow this function shall not be acceptable.
22. The system shall support up to 32 individual Time Code Event lists.

2.19 CONTROL CONSOLE- BLACK BOX THEATRE

A. General:

1. The lighting control console shall be a microprocessor-based system specifically designed to provide complete control of stage, studio, and entertainment lighting systems. The console shall be the SmartFade 1248 as manufactured by Electronic Theatre Controls, Inc., or equal.
2. The system shall provide control of 512, DMX512 controlled dimmers
3. A maximum of 288 memories, may be contained in non-volatile electronic memory.
4. A playback fader pair shall be provided, with highest level operation for intensity between pair and last action operation within pair. Dynamic rate control shall be provided for playback within the memory stack. Device parameters shall always operate with last action operation,
5. 12 overlapping additive channel sliders shall provide access to individual intensity channels, intensity for devices and parameter controls for devices. The console shall provide three modes of operation: Full Control Mode and two playback-only modes (Playback only and Control with Playback). In playback only modes, no recording functions shall be accessible to the user. Selection of the operating mode shall be a menu option in the LCD display.
6. Console shall not require the use of an external monitor for normal use.
7. Console software upgrades shall be made by the user via USB connection to a PC or by SD card. Changing internal components shall not be required.
8. The console shall provide an SD memory card socket allowing show data to be saved for archival or transfer to other consoles or a personal computer.
9. Systems that do not provide the above capabilities shall not be acceptable.

B. Controls and Playback:

1. Programming Section:
    a. The console shall provide LCD display with button and dial controls for navigation. The LCD shall provide system configuration, show data and channel level information.
    b. The console shall provide dedicated buttons for device selection, recording, editing and selecting groups and memories, recording sequences and snapshots, copying memories and sequences, selecting and editing effects, and parameter “fan”.
2. Playback Section:

a. Full Control mode shall provide manual single scene operation and memory operation. Switching among these playback options shall be provided through direct keys.

3. Channel Faders:

a. 12 proportional, fully overlapping faders shall be provided with 45mm potentiometers and bump buttons.

b. The 12 faders shall provide direct manual control of intensity for all channels and devices, as well as direct parameter control for patched devices. Channel levels and parameter settings can be changed at any time by the individual channel sliders.

4. Master faders and Blackout key:

a. A 60mm Master Potentiometer shall be provided that shall master output levels of all intensity channel faders and the crossfader. An alternate action Blackout key shall be located near the Master fader.

b. A 60mm Bumps potentiometer shall be provided that shall master the maximum output level of the intensity channel bump buttons.

C. Operating Modes:

1. Full Control Mode:

a. Full Control mode shall provide 24 intensity channels in two blocks of 12 faders, an additional 12 device channels and two independent channels. Channel faders shall have bump buttons that illuminate proportionally to mimic the output level. Bumps shall operate in pile-on and solo modes.

b. The mode shall provide both 1-to-1 and custom DMX patches. All 1,024 DMX addresses may be patched to the 74 available intensity, device and independent channels.

c. The Next function shall allow manual, preset -style playback of all 72 channels using the two blocks of channel faders and the crossfader GO button.

d. Faders shall also control up to 288 (12 pages of 24) recordable memories. Memories shall record user-selected channel levels.

e. Twelve faders shall provide control of up to 144 sequences (12 pages of 12 faders). Sequences shall include up to 24 steps containing channel levels and/or recorded memories. Steps shall be editable, each with different timing as required, and steps shall be able to be individually deleted and inserted.

f. A cue stack of up to 199 steps shall be provided. Steps may contain a reference to a recorded memory or a direct cue made up of channel levels and parameter settings. Steps shall be editable and steps shall be able to be individually deleted and inserted.

g. The cue stack and sequences shall be able to be played back using manual fades, timed fades, or overridden timed fades using the Rate function.

h. Preview of recorded memories and sequences shall be provided in the LCD display.

i. Snapshot memories shall provide temporary storage of up to 10 looks.

j. An Undo command shall undo the last record command executed.

k. A bump level master shall be provided.

l. A grand master fader and black out button shall be provided.

m. Two independent channels shall be provided with on/off functionality. Independents may be patched like any other channel.

n. Output levels shall be displayed in the LCD menu.

2. Playback Only Mode:
   a. Memories and the stack shall be accessible for playback.
   b. Patch, configuration and editing functions shall be inaccessible in this mode.
   c. Manual control of devices shall be suppressed in this mode.
3. Control with Playback Mode:
   a. Memories and the stack shall be accessible for playback.
   b. Patch, configuration and editing functions shall be inaccessible in this mode.
   c. Manual control of devices shall be available in this mode.
4. MIDI Operation:
   a. The console shall be able to receive MIDI data.
   b. Two consoles shall be able to be connected via MIDI. One unit is set to master and the other to slave.

D. Interface Options
1. The console shall provide connectors for the following:
   a. AC or 12V DC input for external power supply
   b. DMX512/1990 output
   c. MIDI In
   d. MIDI Out
   e. USB input (Series B device connector)
   f. SD Memory Card socket

E. Physical
1. All operator controls and console electronics shall be housed in a single desktop console.
2. SmartFade 1248 console shall be 27" nom. wide x 10" x nom. deep x 2.5" nom. high (including controls). Weight APPROX 3.6kg ~ 8lbs.
3. Console power shall be 12V AC or DC via an external power unit. The power unit shall operate with 90-265VAC line voltage, 50 or 60Hz. Console is provided with a universal power supply and cord set. Consoles that require different power supplies and cord sets for differing power types shall not be acceptable.
4. A vinyl dust cover is available.

2.20 RADIO REMOTE FOCUS UNIT

A. The Remote Focus Unit shall be a rugged hand held remote which will allow the user to set channel levels, check dimmers, or run cues from any location in the theatre. Fade times, channel levels, and cue numbers shall be able to be viewed on three LED displays. Stage and blind modes shall allow for easy cue composition and playback. Unit shall be compact to allow easy interface with the console and is a radio signal remote, using Net3 protocol

2.21 ARCHITECTURAL CONTROL PROCESS (ACP)

A. The Architectural Control Processor shall be the Unison Paradigm P-ACP Series Control Processor as manufactured by Electronic Theatre Controls, Inc.,

1. The Architectural Control Processor (ACP) assembly shall be designed for use in DRd Series Dimming Enclosures and ERn Series Control Enclosures.
2. The processor shall utilize microprocessor based, solid state technology to provide multi-scene lighting and building control.ACP module electronics shall be contained in a plug-in assembly.
3. The module shall be housed in a formed steel body and contain no discrete wire connections.
4. No tools shall be required for module removal or insertion.

B. The ACP shall be convection cooled.

C. User Interface
1. The ACP shall utilize a backlit liquid crystal display capable of graphics and eight lines of text.
2. The ACP shall provide an alpha-numeric keypad for data entry and navigation.
3. The ACP shall provide a touch-sensitive control wheel for navigation.
4. The ACP shall provide shortcut buttons to assist in navigation, selection, and data entry.
5. The ACP keypad, buttons, and wheel shall be backlit for use in low-light conditions.
6. The backlight shall have a user selectable time out, including no time out.

D. The ACP shall provide a front-panel RJ45 jack for Ethernet connection to the processor for configuration, live control, and web-browser-based system access.
1. The Ethernet port shall be secured behind the locking door.

E. The ACP shall provide a Secure Digital (SD) Removable Media slot on the front panel for transfer of configuration data.
1. The SD slot shall be secured behind the locking door.

F. The ACP shall provide a Universal Serial Bus (USB) port on the front panel for transfer of configuration data.
1. The USB port shall be secured behind the locking door.

G. Architectural Lighting System configuration and program information shall be stored in flash memory, which does not require battery backup.
1. The ACP shall provide a Compact Flash (CF) Card as backup flash memory and storage.
2. The CF Card is stored in the back of the ACP, and can be accessed only by removing the ACP.
3. The ACP data can be exchanged by inserting the CF card into another ACP.

H. Electrical
1. The ACP shall require no discrete wiring connections; all wiring shall be terminated into Dimming or Control Enclosure.
2. The ACP shall require low-voltage power supplied by the Dimming or Control enclosure.
3. The ACP shall be hot-swap capable.
4. The ACP shall support Echelon Link Power communications with remote devices, including button stations, button/fader stations, Touchscreen stations, sensors, and third party LonMARK compliant products.
5. The LinkPower network shall utilize polarity-independent, low-voltage Class II twisted pair wiring, type Belden 8471 (unshielded) or Belden 8719 (shielded) or equivalent. One # 14 AWG drain wire will be required for system not using grounded metal conduit. Touchscreen stations, interface

stations and portable stations connectors will also require (2) #16 AWG wires.

a. The LinkPower network shall be topology free. Network wiring may be bus, loop, home run, star or any combination of these.

b. Link power wiring shall permit a total wire run of 1640 ft. (500m) without a repeater. Repeater option modules shall be available to increase wiring maximums in increments of 1640 ft. (500m).

c. Link power wiring between stations shall not exceed 1313 ft. (400m).

d. The ACP shall support 10/100BaseTX, auto MDI/MDIX, 802.3af compliant Ethernet networking using TCP/IP, ESTA BSR E1.17 Advanced Control Networks (ACN) and ESTA BSR E1.31 (sACN) Protocols for internal communication and integration with third-party equipment.

I. The ACP shall support EIA-RS232 serial protocol for bi-directional command and communication with third-party equipment.

J. The ACP shall support two discrete ESTA DMX512A ports, configurable as input or output ports.*

K. *When used in a Dimming Enclosure, the second port is always an output port.

L. The ACP shall provide four onboard dry contact closure inputs for integration with third-party products.

M. The ACP shall provide four onboard contact closure outputs, rated at 1A@30VDC, for integration with third-party equipment.

N. Functional

1. Capacity:

a. Shall support 1024 channels of control

b. Shall support 2 physical DMX ports, each of which may be configured as an input or output

2. System:

a. Runtime application shall utilize support Net3 system interoperability

b. System shall support the use of Network Time Protocol for real time clock synchronization

c. System shall support remote firmware upload an over Ethernet connection from a connected PC running the Light Designer software or another connected processor.

d. System shall support local firmware upload from removable media (SD Card, USB Flash Drive)

3. Diagnostics:

a. Shall output an Event log

b. Standard log shall store a fixed-length history of recent activity

c. Separate critical log shall only store important messages (such as boot-up settings)

4. Configuration Data:

a. Configuration Data can be uploaded over an Ethernet connection from a PC running Light Designer application

b. Configuration Data can be retrieved from another Paradigm Processor

c. A Paradigm Processor shall make its configuration data available for retrieval by another Processor as a backup/recovery mechanism

d. Configuration Data shall be stored on solid-state media that can be removed to facilitate transfer between Processor units

e. Configuration Data may be loaded to and from removable media access provided on front panel

f. Configuration Data for the entire System shall be available for download from any single Processor

g. Shall store configuration data for Dimming enclosure processors and shall make available for download

5. Scalability:

a. Adding additional Processors to a System shall proportionately increase its overall capabilities up to a maximum System size

b. The maximum number of Processors configured as a System shall be at least 12.

c. Multiple Processors shall utilize the Ethernet network to remain time synchronized and share control information

d. Multiple Processors shall utilize the Ethernet network to maintain configuration data synchronization as modifications are made

e. Failure of a single Processor shall not prohibit continuing operation of the remaining Processors

f. It shall be possible for multiple Systems to coexist on the same physical network with logical isolation between Systems

6. Local User Interface:

a. Shall provide access to Processor setup (IP address)

b. Shall provide access to Processor status and diagnostics

c. Where the Processor is installed within a Dimming enclosure, shall provide access to Dimming enclosure setup, status and diagnostics

d. Shall provide control functionality for Control Channels, Zones, Fixtures, Groups, Presets, Macros, Walls and Sequences within the current configuration.

e. Shall provide functionality to schedule astronomical and real time events (add/edit/delete)

f. Shall allow for display of local DMX information

g. Shall allow for transfer of log files to local removable media

h. Shall allow to perform firmware upgrades for connected Dimming enclosures

i. Shall allow for transfer of configuration to and from Dimming enclosures using removable media

j. Shall allow for transfer of configuration to and from LCD Stations using removable media

k. Shall allow for binding of Stations

7. Access Controls:

a. There shall be 2 user accounts - Administrator, and User with separate password protection

b. Account and password settings shall be local to each Processor

c. Access Controls shall be applied to certain areas of the Paradigm Local User Interface and Web Interface

8. Web User Interface:

a. Shall be an internal web server accessible via Ethernet port
b. Shall support common web browsers on Windows and Mac platforms
c. Shall provide functionality to Activate and Deactivate Presets
d. Shall provide functionality to schedule timed events (add/delete)
e. Shall display status information
f. Shall display log files
g. Shall allow for configuration of Processor settings (date, time)
h. Shall allow for upload and download of configuration data
i. There shall be links to other web-enabled devices in the System, including other Paradigm Processors

9. Stations:
    a. Stations shall be connected to a Paradigm Processor via a LinkPower network or Ethernet
    b. Station discovery and binding shall be accomplished from the Local User Interface or Light Designer

O. Net3 and ACN Devices:
1. Net3 Devices shall be connected to and controlled from Paradigm Processors via Ethernet
2. Paradigm Processors shall provide DMX-Net3 gateway functionality
3. It shall be possible to send and receive Macro triggers defined within the System configuration via Net3
    a. There shall be support for Streaming ACN on up to 24 universes per Processor

P. Operation:
1. When contained in an dimming enclosure, a snapshot of the dimming enclosure output data shall be stored in persistent memory so that hardware can access it for immediate output on boot
2. DMX output refresh rate shall be configurable
3. There shall be support for 16-bit DMX Attributes
4. DMX inputs may be patched to DMX and Streaming ACN outputs as external sources
5. Streaming ACN inputs shall be patched to DMX outputs (gateway) as external sources
6. Where there are multiple external sources then priority and HTP shall be used to perform arbitration
7. External and internal sources shall be arbitrated based on user-selection of standard or custom rules
8. On Preset Record, the values of Attributes within the Preset shall be updated to reflect the current output
9. The total output may be the combination of many different Presets running concurrently
10. There shall be no hard limit on number of concurrent cross fades
11. Multiple Presets controlling the same Attribute shall first interact based on priority and second based on Latest Takes Precedence(LTP) or Highest Takes Precedence (HTP)
12. LTP and HTP operation shall be supported simultaneously and interact (at the same priority) using HTP

13. Settings due to LTP Presets may be automatically discarded from operation when overridden
14. It shall be possible to specify that a Preset or Attribute Control will persist when overridden
15. A Preset may be designated as an HTP Override and shall cause HTP values to be discarded
16. It shall be possible to modify the rate of a Preset (Cross fades, Effects) from a Control within the System
17. Each Preset shall have a status that can be Activated, Deactivated or Altered
18. Preset status may be set based on matching levels in the current output as an option
19. On startup the System shall be capable of automatically executing timed events within the previous 24 hours to synchronize its initial output state with the current time of day

Q. Serial Input/output:

1. RS232 shall support 8-bit word length, parity selection and 1 or 2 stop bits
2. RS232 shall support baud rates from 4800 to 115,200 bps
3. Serial input and output messages are fully customizable
4. Serial output messages can be generated by any Control or Event

2.22 ARCHITECTURAL CONTROLS

A. Mechanical

1. Preset/Fader Stations
    a. Unison Preset/Fader stations shall operate using up to twelve programmable buttons and sixteen programmable faders with integral LEDs.
    b. Fader stations shall utilize standard 45 millimeter slide potentiometers.
    c. All Preset and Fader stations shall be available with white, ivory, gray or black faceplates, fader knobs, and buttons. All faceplates shall be designed for flush or surface mounting.
    d. Station faceplates shall be constructed of ABS plastic and shall use no visible means of attachment.
    e. The manufacturer shall supply back boxes for flush mounted half gang stations and for all surface mounted stations.
2. LCD Stations
    a. LCD stations shall consist of a back-lit liquid crystal display (LCD) with a touchscreen interface. The LCD station shall operate using graphic buttons, faders and other images on up to 30 separate programmable control pages.
    b. Flush or surface wall mounted stations shall be available with white, ivory, gray and black faceplates.
    c. Station faceplates shall be constructed of ABS plastic and shall have no visible means of attachment.
    d. The manufacturer shall provide back boxes for all LCD stations.
        1) Flush back box dimensions shall be 5.25H x 8.5W x 3.25D.
        2) Surface back box dimensions shall be 5.75H x 9.12W x 3.25D.
    e. LCD stations shall be available in white and black portable desk top consoles with cable and connector.

f. It shall be possible to adjust LCD contrast and brightness. It shall also be possible to program the station to dim to any level during periods of inactivity.

B. Electrical

1. Unison control station wiring shall be an Echelon® Link power network.
2. Link power shall utilize low-voltage Class II unshielded twisted pair, type Belden 8471 or equivalent, and one #14 ESD drain wire (when not installed in grounded metal conduit).
3. LCD stations shall also require (2) #16 AWG stranded wires for 24Vdc operating power. 24Vdc wiring shall be topology free.
4. Network wiring may be bus, loop, home-run or any combination of these.
5. Network insulation displacement connectors shall be provided with all stations.

C. Functional

1. The Unison Control System shall be designed to allow control of lighting and associated systems via Preset/Fader, LCD, IR or Astronomical time clock controls. System shall allow the programming of presets, macros and time clock events.
2. System presets shall be programmable via Preset/Fader, LCD or Light Manager software.
   a. Presets shall have a discrete fade time, programmable from zero to 1,000 hours with a resolution of one millisecond.
   b. Presets shall be selectable via button, fader, IR transmitter, time clock event, macro activation or switch interface stations.
   c. System time clock events shall be programmable via Light Manager system software.
3. Station (Preset/Fader, LCD or IR) control components shall be designed to operate standard default or custom system functions. Components shall operate default functions unless re-assigned via Light Manager, the Windows-based configuration program.
   a. Optional button functions include: preset selection, manual mode activation, record mode activation, station lockout, raise, lower, macro activation, cue light, or room join/separate.
   b. Optional fader functions include manual master control, individual zone control, fade rate control or preset master control.
4. Stations (Preset/Fader, LCD and IR) shall allow programming of station and component electronic lock-out levels via Light Manager. LCD stations shall also allow programming of page pass-code and visibility levels.
5. LCD stations shall support import of bitmap images files to custom LCD control pages.
6. LCD stations shall support the control of DMX512 automated fixtures via graphic XY faders.

2.23 REMOTE PLUG-IN STATION

A. The Remote Plug-in Stations shall consist of the appropriate connectors required for the system in use. These stations shall be available with DMX input or output, Remote Focus Unit, ETCNet, ETCLink or architectural control connectors. Custom control connectors shall be available.

B. The following standard components shall be available for Remote Plug-in Stations:

1. 5-Pin male XLR connectors for DMX input
2. 5-Pin female XLR connectors for DMX output
3. RJ45 connectors for ETCNet connections - Twisted Pair

C. Custom combinations and custom control connections shall be available.

D. Station faceplates shall be .80” aluminum, finished in fine texture, scratch-resistant black powder coat. Silk screened graphics shall be white.

E. The station panel shall mount into an industry standard back box, depending on size and quantity of connectors. A terminal block shall be supplied for contractor terminations.

2.24 DISTRIBUTION

A. Wiring devices shall be fabricated from 16-gauge cold rolled steel or extruded aluminum. Devices shall be properly cleaned, primed and painted with flat black baked enamel. Circuit numbers shall be 2"high.

B. Individual pigtails and outlets shall be evenly spaced in connector strips, or as otherwise specified. Where a circuit would fall on a joint it shall be moved 3" towards the junction box end of the strip.

C. Pigtails shall be three-wire type "SO" rubber jacketed cable sized for the circuit capacity. Connectors are 20A Grounded Stage Pin connectors. Internal wiring shall be sized to circuit capacity and terminated in feed through compression terminals at one end for ease of installation. Wire shall be rated at 125°.

D. Devices except for wall mounted boxes shall be supplied with appropriate hardware for mounting as shown on the drawings. Connector strips shall have brackets on 5' centers.

E. For connector strips provide pantograph cable management system as required to allow all devices to fly within 4’ above finished floor.

F. Plug boxes shall be mounted as indicated with scheduled circuit outlets.

2.25 FIXTURES

A. Ellipsoidals:

1. The ellipsoidal spotlights shall be the Source Four or Source 4 Jr. as specified.
2. Source Four's high efficiency lamp shall utilize a compact tungsten filament contained in a krypton-filled quartz envelope. The lamp base shall be an integral die cast aluminum heat sink that reduces seal temperature and ensures proper lamp alignment.
3. The lamp shall be 575 Watts with 16,500 lumens, with a color temperature of 3,250 K and have 300 hours of lamp life.
4. Source Four's optical train shall combine a compact filament lamp with a precision molded borosilicate, ellipsoidal reflector and a single aspheric lens to produce an optimum cosine field.
5. Source Four ellipsoidal spotlights are constructed of rugged, die cast aluminum, finished in black, high temperature epoxy paint. Tools are not required for either lamp alignment or cleaning the reflector or lens. Precision tooled mechanical assemblies provide smooth operation, positive locking of adjustments and interchangeable components.
6. Source Four ellipsoidal shall provide, but not be limited to:
    a. Die cast aluminum housings
    b. Integral cable clamp for power leads
    c. Positive locking of lamp focus
    d. Independent lamp alignment controls
    e. High impact, thermally insulated knobs and shutter handles
    f. Reflector secured with shock mounts
    g. Rotating shutter assembly for keystone angles

h. Heavy gauge stainless steel shutters
i. Lens secured with silicone shock mounts
j. Interchangeable lens tubes for different fields
k. Teflon guides for smooth lens tube movement
l. Sturdy gel frame holders with two accessory slots
m. Top mounted, quick release gel frame retainer
n. Rugged steel yoke with two mounting positions
o. 300+ Rotation of fixture within yoke
p. Positive locking, hand operated yoke clutch

B. Pars:
1. The instrument shall be a Source Four Par.
2. The instrument shall utilize a 575 watt HPL lamp which is a compact tungsten filament contained in a krypton-filled quartz envelope.
a. The lamp shall mount axially within the reflector and shall be prefocused within the reflector.
b. The lamp base shall have a integral die cast aluminum heat sink that reduces seal temperature and ensures proper lamp alignment.
c. The lamp socket shall be ATP 220 nickel gold plated.
d. All versions of the instrument shall use only lamp type, the HPL lamp. Fixtures which require the purchasing of multiple lamp types to achieve different field angles shall not be acceptable.
3. The spotlights are constructed of rugged, die cast aluminum, free of burrs and pits, finished in black, high temperature epoxy paint. Tools shall not be required for cleaning the reflector or lens
4. The spotlight shall provide, but not be limited to:
a. Integral cable clamp for power leads
b. High impact, thermally insulated knobs
c. Sealed reflector housing shall prevent all light leaks. Temperature control of reflector is obtained through 17 heat sink fins cast into the housing.
d. Interior of unit shall contain ten baffles to eliminate beam scattering and spill light.
e. Lamp socket shall be held into place by a brass self retaining screw.
f. Lens shall be secured with cast bosses and high temperature bronze spring release. No tools shall be required to change lenses.
g. Sturdy gel frame holders with two accessory slots and a top mounted, quick release gel frame retainer
h. Rugged steel yoke with two mounting positions 300°+ Rotation of fixture within yoke
i. Positive locking, hand operated yoke clutch
j. Each unit shall be provided standard with color frame and 36” bare lead.
k. Unit shall be nominally 11”long by 10” wide
l. Weight without “C” clamp shall be 8 lbs.
5. The spotlight shall be UL and CUL approved

a. It shall be possible to change field type of the spotlight through interchangeable lenses. No tools shall be necessary for lens changing. 360° Beam rotation shall be possible while the unit is active. No tools shall be necessary for lens rotation. Fixtures which require user to touch the lamp or lamp socket to orientate the beam shall not be acceptable.

b. Interchangeable lens sets shall consist of clear, very narrow spot, narrow spot, medium flood, and wide flood. Lenses shall be heat resistant, borosilicate glass.

c. Beam orientation of MFL and WFL lenses shall be possible through rotation of lenses in a rotatable collar housed in the front of the unit. Collar shall be a high temperature heat resistant rotating collar with finger holds for precise movement.

d. The optical train shall combine a compact filament lamp with modified parabolic and multifaceted reflector. Reflector efficiency shall be a minimum of 93%. Reflector shall be cast into a heat sink assembly. Reflector finish shall be an enhanced aluminum deposition. Reflectors of pressed aluminum sheet construction shall not be acceptable.

C. Fresnel Spotlight

1. General:

a. The luminaire shall be a Source Four Fresnel spotlight as manufactured by Electronic Theatre Controls, Inc., or approved equal

2. Lamp

a. The luminaire shall utilize only the HPL lamp, which shall consist of a compact tungsten filament contained in a krypton-filled quartz envelope

b. The lamp base shall have an integral die cast aluminum heat sink that reduces seal temperature and ensures proper lamp alignment

c. Luminaires that use lamps other than the HPL lamp shall not be acceptable

d. The lamp socket shall be ATP 220 nickel gold plated

e. The lamp shall be prefocused in relation to the reflector

f. The lamp shall be removable from the bottom of the fixture for re-lamping

3. Optical

a. Luminaire shall use a Fresnel lens and provide soft-edged, but well-defined beam shaping with a barn door attachment

b. Luminaire shall provide a field angle zoom range of 20 degrees to 65 degrees

c. The optical train shall utilize a compact filament lamp with a modified spherical reflector

d. The luminaire shall output no less than 10,000 field lumens in full flood setting when fitted with 750W, 115V high out-put HPL lamp

e. Luminaires producing less than 10,000 field lumens in full flood setting with a 750W lamp shall not be acceptable

f. Reflector shall be molded borosilicate glass with multiple dichroic layers

g. Reflector efficiency shall be a minimum of 93%

h. Reflectors of pressed aluminum or other sheet metal construction shall not be acceptable

4. Physical

a. The luminaire shall be constructed of rugged, die cast aluminum, free of burrs and pits, finished in black, high temperature paint

b. The luminaire shall provide, but not be limited to:

1) 36” power lead with bare-ends

2) Integral cable clamp for power leads

3) Sealed housing with no light leaks

4) Zoom adjustment by means of a large, side-mounted knob with integral locking lever

5) Bottom-access lamp removal

6) Lamp socket access door shall use a tool-free ¼-turn closure device

7) Two accessory slots and a top mounted locking door for gel frames and beam control accessories

8) Accessory slots shall be completely surrounded by a rugged metal housing for elimination of light leaks around gel frames and other beam control accessories

9) Accessory slots shall be compatible with 7.5” beam control accessories, i.e. barn doors, gel frames, top hats, etc, such as used by Source Four PAR luminaires and other similarly-sized fixtures

c. Rugged steel yoke

d. Adjustable yoke mounting position for variable fixture balance point

e. Positive locking, hand operated yoke clutch

f. Large, rugged handle on rear of fixture

g. Integrated safety cable mounting ring

h. Color frame

5. Unit shall be nominally 12.5”long by 9.5” wide

6. Weight without “C” clamp shall be 13.25 lbs.

7. The luminaire shall be capable of utilizing ETC Dimmer Doubling technology

8. The luminaire shall be ETL and cETL listed to UL 1573 – the standard for stage and studio use and so labeled

D. Cyc Fixtures

1. Luminaire shall be compact lightweight cyclorama light constructed of 18-gauge steel. Construction shall employ all corrosion-resistant materials and hardware.

2. The luminaire shall be for use with 300 to 1500-watt tungsten halogen lamps. Each unit shall have adjustable lamp holder, which allow the luminaire to accept T-3 to T-8 lamps of three different lengths:4-11/16” (119mm), 5-5/8” (143mm), and 6-9/16” (167mm). Units not incorporating this feature shall not be acceptable.

3. Luminaire shall be provided with a highly polished and peened reflector with heat sink. Units not incorporating this feature shall not be acceptable.

4. A super thin safety screen is specially designed to allow maximum light output, and is readily removable for easy access to the lamp for quick installation and replacement.

5. Luminaire shall be provided with a rugged 18-gauge steel joining bracket, which allow multiple units to be safely locked together. Units not incorporating this feature shall not be acceptable.

6. Luminaire shall accept a wide selection of yokes and other hanging hardware to accommodate virtually all sky cyc mounting configurations.

7. Luminaire shall accept a hinged color frame, which is removable without the use of tools.
8. The luminaire shall be U.L., c.U.L. Listed and CE Certified and labeled for use with up to 1500-watt lamps. Luminaire shall have a New York City Calendar Number.
9. The luminaire shall be #EC-1, as manufactured by Altman Lighting, Inc., Yonkers, NY.

E. Work Light Fixture

1. The worklight fixture shall be a die cast aluminum housing with a high temperature lens enclosing the lamp.
2. The fixture produces a wide uniform beam for general illumination of stage area.
3. Optional features include wire lens guard and top and side visors.
4. Fixture shall be a complete assembled fixture with the following items included:
    a. Gray housing with high temperature lens
    b. 36” pigtail with your choice of plug installed:
        1) 2P&G stage pin plug
        2) L520 twist lock plug
        3) 520 parallel blade plug
    c. Halogen T-3, 500W, 120V lamp
    d. Mounting c-clamp•
    e. Safety cable and safety cable eye bolt
5. Fixture shall be optionally available with the following:
    a. Wire lens guard
    b. Top and side visors•
    c. 1,000 watt unit available (contact factory)
6. Fixture shall be the SSRC SWLF-1-QL505 Worklight Fixture with 500 watt lamp

F. Canto 700w Followspot

1. General
    a. The instrument shall be a CANTO 1200 followspot, as marketed by Strong Entertainment Lighting, a division of Ballantyne of Omaha, Inc. or approved equal.
2. Physical
    a. The unit frame and enclosure shall be constructed of cold rolled steel and sturdy aluminum extrusions, free of burrs and protected by a black powder coat finish.
3. The following shall be provided:
    a. Spotlight head mounting by means of 1.125 inch (28mm) diameter spigot
    b. Separate, easily exchanged metal halide power supply with quick-disconnect receptacle
    c. Uninterrupted operation cycle
    d. Lamphouse is forced-air cooled by internally wired blower
    e. Manual dimming control
    f. Nichrome steel iris

g. Spot edge focus adjustment capability

h. Weight of head unit not to exceed 37 pounds (16.4kg)

i. Factory options shall include both a height-adjustable tripod floor stand and a five-color self-canceling boomerang with (5) color filters

4. Optical

a. The unit shall combine a 1200 watt metal halide lamphouse with reflector and double condenser optical system and variable focus lens system which increases light intensity as spot diameter is decreased.

b. Reflector and double condenser optics operating in a fixed position

c. Provision for plug-interchangeable, socket mounted 575 watt single-ended metal halide bulb

d. Drop-down lamp holder to permit bulb replacement without use of hand tools

e. Bulb positioning controls accessible from exterior of lamphouse

5. Electrical

a. Metal halide bulb system; input 110-120 V.AC, 50/60 Hertz, single phase, 7 ampere sustaining and fused for 16 amperes

b. Metal halide power supply separate from spotlight unit and easily interchanged

c. Metal halide bulb (furnished separately) shall be 1200w manufactured by Philips Lighting or approved equal

2.26 BILL OF MATERIALS – LIGHTING, DIMMING CONTROL AND DISTRIBUTION

A. Main Theater - Unless otherwise indicated on the drawings provide the following:

1. (3) SR 48 Sensor3 Dimming Cabinets w/CEM3 control module
2. (2) BK 48
3. (1) ELTS as shown in drawings
4. (144) D20 Modules
5. (1) "DCP" Equipment rack19" Wall mount w/

a. (1) Architectural processor

b. (1) POE 24 port switch

c. (1) 24 way Cat 5patch bay

d. (1) cable management panel

e. (24) 12" Cat 5 patch cables

f. (1) Rack storage dwg

g. (as nec) Blank Filler plates

h. (1) UPS

6. (1) Ion 1000 Control Console
7. (1) Ion Fad 2x 20 Fader Wing
8. (2) 19" Flat Screen LCD Video Monitors
9. (1) radio remote focus

10. (4) Portable 2 port Touring Node
11. (2) 25' cat 5 net cables
12. (2) 10' cat 5 net cables
13. (1) Lot Architectural control station as detailed on dwg
14. (1) Lot Lighting System control plug in stations as detailed on drawings
15. (1) Lot distribution raceways and boxes as detailed in drawings
16. (12) 419 sc4 Ellipsoidal Spots -CWANA
17. (24) 426 sc4 Ellipsoidal Spots- CWANA
18. (12) 436 Sc4 Ellipsoidal Spots- CWANA
19. (12) 450 Ellipsoidal Spots- CWANA
20. (30) Sc4 Fresnel- CWANA
21. (12) Sc4 Par EA CWANA
22. (10) Altman Econo Cyc -4 cell
23. (10) FC2x2y 2 over 2 mounting bracket and hardware for Econo Cyc
24. (12) SSRC Worklight w/500 watt lamp
25. (1) Canto FS
26. (20%) Spare lamps for all fixtures listed above
27. (10) 12/3 SO Molded stage pin two-fers
28. (10) 5' 12/3 SO Stage Pin Jumpers
29. (10) 10' 12/3 SO Stage Pin Jumpers
30. (10) 25' 12/3 SO Stage Pin Jumpers
31. (2) 50' 12/3 SO Stage Pin Jumpers
32. (1) Lighting Plot Layout
33. (1) Fixture Hang and Focus
34. CWANA = with C-Clamp, Safety cable, Color frame, and manufacturer installed 20A. Stage Pin Connector (unless otherwise noted)

B. Black Box - Unless otherwise indicated on the drawings provide the following:

1. (1) SR 48 Sensor3 with CEM3 control module
2. (48) D20 Dimming modules
3. (1) ETC Smart fade 24/48 control console
4. (1) 10' DMX control Cable
5. (1) 50' DMX Control Cable
6. (1) Lot Architectural control station as detailed on dwg
7. (1) Lot Lighting System control plug in stations as detailed on drawings
8. (1) Lot distribution raceways and boxes as detailed in drawings
9. (24) SC 4 junior zoom 25 -50 CWANA

10. (12) Sc 4 Par EA CWANA
11. (6) SSRC Worklight
12. (12) Barn Doors for Sc4 Par
13. (5) 10' 12/3 SO Stage Pin Extension Cables
14. (5) 25' 12/3 SO Stage Pin Extension Cables
15. (20%) Spare lamps for all fixtures listed above
16. CWANA = with C-Clamp, Safety cable, Color frame, and 20A. Stage Pin Connector

PART 3 - EXECUTION

3.01 GENERAL

A. Verify that job conditions are ready to receive work of this section. Notify Architect of any existing condition which will adversely affect execution. Beginning of execution will constitute acceptance of existing conditions.

B. Verify that field measurements are as shown on shop drawings.

C. Verify that mechanical, electrical, and other items affecting work of this section are in place and ready to receive the work

D. Some equipment to be turned over to others for installation as indicated herein All other equipment detailed in this section to be installed by this contractor.

3.02 INSTALLATION

A. This contractor shall be responsible for installation of all equipment unless noted as turn over to other

3.03 SOME EQUIPMENT TO BE TURNED OVER TO OTHERS FOR INSTALLATION AS INDICATED HEREIN ALL OTHER EQUIPMENT DETAILED IN THIS SECTION TO BE INSTALLED BY THIS CONTRACTOR.

A. This contractor shall be responsible for coordination and tracking of all material indicated as turn over to others for installation.

B. Install using skilled workmen in accordance with manufacturer's printed instructions and recommendations.

C. Install work in accordance highest industry standards. Handle materials to avoid dents and other damages.

D. All Equipment shall be installed using only properly load rated hardware

E. Set and secure materials and components rigid, plumb, and square

F. Equipment and materials sensitive to dirt, dust, moisture- including but not limited to Stage Curtains, lighting fixtures, and any motorized equipment shall only be installed after building is suitability dry and conditions and dust free. Curtains and light fixtures shall only be installed after temporary C/O has been issued and building has been final cleaned.

END OF SECTION

SECTION 11 6623
GYMNASIUM EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following gymnasium equipment:

1. Basketball equipment.
2. Physical Education equipment.
3. Safety pads.
4. Floor sleeves for pipe standards.
5. Mat hoists.

B. Related Sections include the following:

1. Division 11 Section "Gymnasium Dividers."
2. Division 16 Electrical.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, attachments to other work, and the following:

C. Structural analysis data signed and sealed by the qualified professional engineer registered in the Commonwealth of Virginia responsible for their preparation including loads, point reactions, and locations for attachment of gymnasium equipment to structure.

D. Samples for Initial Selection: For each type of gymnasium equipment indicated.

E. Samples for Verification: For the following products:

1. Pad Fabric: Not less than 3 inches square, with specified treatments applied. Mark face of material.

F. Qualification Data: For Installer and professional engineer.

G. Operation and Maintenance Data: For gymnasium equipment to include in emergency, operation, and maintenance manuals.

H. Warranty: Special warranty specified in this Section.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain each type of gymnasium equipment through one source from a single manufacturer.

1.04 PROJECT CONDITIONS

A. Environmental Limitations: Do not install gymnasium equipment until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Verify position and elevation of floor inserts and layout for gymnasium equipment.

1.05 COORDINATION

A. Coordinate layout and installation of overhead-supported gymnasium equipment and suspension system components with other construction including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

1.06 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of gymnasium equipment that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Basketball backboard failures including glass breakage.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Equipment Wall-Mounting Board: Wood, neutral-color painted finish, size, and quantity as required to mount gymnasium equipment according to manufacturer's written instructions.

B. Anchors, Fasteners, Fittings and Hardware: Manufacturer's standard corrosion-resistant or noncorrodible units; concealed; tamperproof, vandal- and theft-resistant design.

2.02 BASKETBALL EQUIPMENT

A. Manufacturer - Basis-of-Design: Porter Athletic Equipment Company; refer to equipment schedule at end of section.

1. Other Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Draper Inc.

b. Jaypro Sports, LLC.

c. Performance Sports Systems.

d. Porter Athletic Equipment Company.

B. Protruding fasteners or exposed bolt heads on front face of backboards are not permitted.

C. Winch: Hoist, consisting of heavy-duty, fully enclosed worm-gear, brake, cable drum, cable, and fittings, for mounting on wall with equipment mounting board; designed to move and hold backboard in any raised or lowered position.

1. Operation: Manual winch with detachable hand crank.

2. Portable Winch Operator: One portable electric motor-drive device(s), including adaptor to fit crank mechanism.

2.03 PHYSICAL EDUCATION EQUIPMENT

A. Manufacturer - Basis-of-Design: Porter Athletic Equipment Company; refer to equipment schedule at end of section.

1. Other Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Draper Inc.

b. Jaypro Sports, LLC.

c. Performance Sports Systems.

d. Porter Athletic Equipment Company.

2.04 SAFETY PADS

A. Manufacturer - Basis-of-Design: Porter Athletic Equipment Company.

1. Other Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Draper Inc.

b. Jaypro Sports, LLC.

c. Performance Sports Systems.

d. Porter Athletic Equipment Company.

B. Pad Coverings: Provide safety pad fabric covering fabricated from puncture- and tear-resistant, not less than 14-oz./sq. yd PVC-coated polyester or nylon-reinforced PVC fabric treated with fungicide for mildew resistance; with surface-burning characteristics indicated.

C. Wall Safety Pads: Padded wall wainscot panels designed to be attached in a continuous row; each panel section consisting of fill laminated to backer board with visible surfaces fully covered by seamless fabric covering, free of sag and wrinkles and firmly attached to back of backer board.

1. Backer Board: Not less than 3/8-inch- thick plywood.

2. Fill: Multiple-impact-resistant foam not less than 2-inch- thick polyurethane; minimum 3.5-lb/cu. ft. density.

3. Size: Each panel section, 24 inches wide by not less than 72 inches long.

4. Number of Panel Sections: As indicated modular panel sections.

5. Installation Method:

a. Walls: Concealed mounting Z-clips.

b. Bleachers: Velcro wall storage strips.

1) Extruded, anodized aluminum mounting strip and semi-rigid velcro, hook-type fastener strip, complying with the following requirements:

(a) Mounting Strip: Aluminum, mounted to bleachers with #12 x 1 lg. phillips pan head srews provided with storage strip.

(b) Strip Lengths: Standard 4 ft; cut to special lengths as required for end conditions and to wrap exposed bleacher corners.

(c) Strip Width: 2-13/16 inches.

(d) Velcro Fastener Width: 1-1/2 inches.

2) Representative Product: Porter No. 00144-440 Wall Stor-Strip.

6. Fabric Covering Color: As selected by Architect from manufacturer's full range for one color.

2.05 FLOOR SLEEVES FOR PIPE STANDARDS

A. Floor Sleeves with Chrome Covers: Similar to Porter Model No. 870; an adaptor must be available for floor sleeve, allowing it to be utilized for 2-3/8 inch diameter and 3-1/2 inch diameter pole stands.

B. Cover plate consists of molded plastic recessed mounting flange, cork gasket and a 5-inch diameter chrome plated cover.

C. Cover shall be equipped with a swivel type retainer pin to prevent theft.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for play court layout, alignment of mounting substrates, installation tolerances, operational clearances and other conditions affecting performance.

1. Verify critical dimensions.
2. Examine supporting structure.
3. Examine wall assemblies, where reinforced to receive anchors and fasteners, to verify that locations of concealed reinforcements have been clearly marked. Locate reinforcements and mark locations.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written installation instructions. Complete equipment field assembly, where required.

B. Unless otherwise indicated, install gymnasium equipment after other finishing operations, including painting, have been completed.

C. Permanently Placed Gymnasium Equipment and Components: Rigid, level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated on Shop Drawings; in proper relation to adjacent construction; and aligned with court layout.

1. Operating Gymnasium Equipment: Verify clearances for movable components of gymnasium equipment throughout entire range of operation and for access to operating components.

D. Wall Safety Pads: Mount with bottom edge at 4 inches above finished floor.

E. Anchoring to In-Place Construction: Use anchors and fasteners where necessary for securing built-in and permanently placed gymnasium equipment to structural support and for properly transferring load to in-place construction.

3.03 ADJUSTING

A. Adjust movable components of gymnasium equipment to operate safely, smoothly, easily, and quietly, free from binding, warp, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and moving parts.

3.04 CLEANING

A. After completing gymnasium equipment installation, inspect components. Remove spots, dirt, and debris and touch up damaged shop-applied finishes according to manufacturer's written instructions.

B. Replace gymnasium equipment and finishes that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

3.05 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain gymnasium equipment. Refer to Division 1 Section "Demonstration and Training."

3.06 EQUIPMENT SCHEDULE - BASKETBALL

A. Suspended Forward Fold Offset Mast Basketball Backstops: Similar to Porter Model No. 950.

1. Vertical front drop frame assembly consists of a main, center mast minimum 6-5/8 inch O.D. heavy wall structural steel tube with diagonal side sway braces.
2. Offset design frame assembly with main stem of the drop frame suspended diagonally from the superstructure with an angle and vertical member for attachment of a fan or rectangular backboard.

3. Top horizontal mast hinge spreader to be a minimum 4 inch structural channel to support adjustable suspension hangers.
4. Goal mounts directly through backboard and into a heavy structural steel weldment clamped to the vertical center support to eliminate any strain on backboard (conforms to the NCAA latest rules).
5. Provide the official NCAA and NFSHSA regulation of 6 inches from the front of the weldment to the face of the backboard with upper bankboard extension assembly.
6. Suspend drop frame by special adjustable hangers (2) to provide for precise plumbing of frame during installation.
7. The camber of the offset main drop frame will properly weight lock unit in the playing position.
8. Backstop to operate with a minimum 1-7/8 inch O.D. front brace assembly with a folding knee joint; knee joint to be adjustable for ease of installation and field adjustment; knee joint locks brace in playing position for maximum rigidity by means of a torsion spring and is easily disengaged by upward force of hoist cable.
9. Support backstop from minimum 3-1/2 inch O.D. pipe anchored to roof framing members by means of heavy formed, die-cut steel support fittings.
10. Each attachment to building roof framing must be capable of supporting a load exceeding 10,000 pounds with sufficient attachment points to acquire a 60:1 safety factor for support of entire backstop support system (certified test results shall be furnished upon request).
11. Reinforce superstructure pipes with special truss-type bridging or bracing when truss centers exceed spans of 14 feet.
12. Provide hoist cable of 1/4-inch diameter galvanized aircraft cable with 7,000 pound ultimate breaking strength.
13. Furnish swivel pulleys with a 4 inch diameter cast (ductile iron) pulley sheave with a maintenance free, oil-impregnated bearing for proper hoist cable routing to winch.
14. Pulley assembly and attachment to 3-1/2 inch O.D. support structure to be rated at a minimum 9,000 pound load rating (certified test results shall be furnished upon request).
15. Goal Height Adjustment:
    a. Provide backstops for rectangular backboards with Porter Model No. 00900-506 height adjustment system.
    b. Height adjustment feature must permit goal height settings from 8 feet to the official 10 feet.
    c. Height adjustment accomplished with a threaded rod equipped with precision, hardened steel roller thrust bearings for ease of operation from the playing floor by means of an awning crank type mechanism.
16. Supporting frame work to be cleaned and given factory coat of enamel matching building framework color, as approved by the Architect.

B. Rectangular Glass Backboard - Main Court: Similar to Porter Model No. 208.
1. Provide backboard 3 feet-6 inches x 6 feet to meet all NCAA, NFHSA and professional requirements.
2. Provide backboard frame of a welded, unitized construction fabricated from heavy wall rectangular steel tubing.
3. Design frame to allow the bottom two goal mount holes to pass beneath the glass section to further alleviate stress on the glass.

4. Provide backside of goal mount structure with two mounting holes and hardware to independently secure backboard to a direct mount goal feature, which relieves all stress and shock on the backboard frame conforming to the latest NCAA Rules.
5. Glass provided in 1/2 inch thick, fully tempered (heat treated) glass section with uniform load and impact strength.
6. Official white border and target area must be "fired in" permanently on front side of glass section.
7. Secure glass section to unitized rear frame by means of an aluminum extrusion.
8. Secure front perimeter frame to unitized rear frame.
9. Fit glass section with shock absorbing neoprene material to cushion and protect the glass section.

C. Goal - Main Court: Similar to Porter Model No. 223.

1. Goal designed to absorb shock loads due to slam dunking or hanging on the rim.
2. Shock absorption feature provided by means of a special offset hinge arrangement rim and backplate mounting housing and a concealed molded rubber shock absorber.
3. Position hinge to place goal return impact forces in shear (parallel) to minimize oscillation induced into the face of the backboard.
4. Mold shock absorber from a rubber formulation to dampen and minimize vibrations and fatigue in the backboard.
5. Front of rim to deflect downward up to 2-1/16 inches when a static load or 250 pounds is applied and instantly return to playing position when load is released.
6. Function of goal must meet the NCAA specifications on movable rims, which state: AA moveable basket ring shall have rebound characteristics identical to those of a non-moveable ring; goal shall be set at factory for proper flex and rebound requirements.
7. Fabricate rim from 5/8-inch diameter cold drawn alloy steel, round formed to an 18 inch inside diameter ring.
8. Position inside diameter of ring 6 inches from face of backboard by a heavy formed steel, hinged type housing with a removable cover to conceal mounting bolts and entire shock absorption mechanism of goal, and also protect against finger entrapment.
9. Provide goal mounting plate with hardware and a 5 inch x 4 inch mounting hole pattern for front mounting on standard glass, wood and fiberglass type backboards.
10. Rim rigidly braced by means of special, formed, die cut steel braces on underside; rim provided with twelve "no-tie" net attachment clips for net attachment.
11. Goal furnished in a durable, official orange powder coat finish.
12. Goal furnished complete with plated mounting hardware and a high quality cotton net.

D. Backboard Padding Kit - Main Court:

1. Pad consists of two pieces with molded type square corners.
2. Pads molded from Polyurethane Foam (minimum 9 pound density) with integral skin (self-skinning).
3. Provide a positive bolt-on type attachment system; glue or peel and stick tape type attachment methods are not permitted.
4. Pad sections provided with internal, molded in steel attachment channel sections that are secured to the backboard with self-drilling, self-tapping attachment hardware.

5. Pad meets all competition requirements of the NBA, NCAA, NFSHSA, and international requirements of FIBA.
6. Color to be selected.

E. Fan Fiberglass Backboard - Side Courts: Similar to Porter Model No. 267-698.

1. Molded fiberglass board shall be official size and shape, with orange perimeter and target area markings.
2. Tensile strength of board to be minimum 8,900 to 11,700 psi with 23 to 27 percent fiberglass content by weight.

F. Goal - Side Courts: Similar to Porter Model No. 00201-H00.

1. Rim fabricated from 5/8 inch diameter cold drawn alloy steel round formed to an 18 inch inside diameter ring.
2. Inside of ring shall be positioned 6 inches from face backboard with heavy L-shaped, formed steel mounting plate.
3. Rim to be rigidly braced with minimum 1/2 inch diameter cold drawn alloy steel round formed and welded in position.
4. Orange powder coat finish.
5. Provide with nylon net.

END OF SECTION

SECTION 11 6653
GYMNASIUM DIVIDERS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes gymnasium divider curtain.

B. Related Sections include the following:

1. Division 26 Sections for electrical service for motor operators, controls, and other powered devices for motorized gymnasium divider.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.

1. If applicable, include assembly, disassembly, and storage instructions for removable equipment.
2. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation including loads, point reactions, and locations for attachment of gymnasium dividers to structure.

D. Samples for Initial Selection: For each type of gymnasium divider curtain fabric indicated.

E. Samples for Verification: For divider curtain fabric, not less than 12 inches square of open mesh, and of opaque fabric.

F. Product Certificates: For each type of gymnasium divider, signed by product manufacturer.

G. Qualification Data: For installer and professional engineer.

H. Operation and Maintenance Data: For gymnasium dividers to include in emergency, operation, and maintenance manuals.

I. Warranty: Special warranty specified in this Section.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain each type of gymnasium divider from a single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.04 PROJECT CONDITIONS

A. Environmental Limitations: Do not install gymnasium divider until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Verify position for gymnasium divider.

1.05 COORDINATION

A. Coordinate installation of overhead-supported gymnasium divider and suspension system components with other construction including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

1.06 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of gymnasium divider that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, faulty operation of gymnasium dividers.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Extruded Bars, Profiles, and Tubes: ASTM B 221.
2. Cast Aluminum: ASTM B 179.
3. Flat Sheet: ASTM B 209.

B. Steel: Comply with the following:

1. Steel Plates, Shapes, and Bars: ASTM A 36.
2. Steel Tubing: ASTM A 500 or ASTM A 513, cold formed.
3. Steel Sheet: ASTM A 1011.

C. Support Cable: Manufacturer's standard galvanized steel aircraft cable with a breaking strength of 7000 lb. Provide fittings complying with cable manufacturer's written instructions for size, number, and method of installation.

D. Support Chain and Fittings: Grade 80 hardened alloy steel chain rated for overhead lifting, ASTM A 391/A 391M, with commercial-quality, hot-dip galvanized steel connectors and hangars.

E. Castings and Hangers: Malleable iron, ASTM A 47, grade required for structural loading.

F. Anchors, Fasteners, Fittings and Hardware: Manufacturer's standard corrosion-resistant or noncorrodible units; concealed; tamperproof, vandal- and theft-resistant design.

2.02 DIVIDER CURTAIN

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Draper Inc.
2. Jaypro Sports, LLC.
3. Performance Sports Systems.
4. Porter Athletic.

B. Divider Curtain: Electrically operated, folding, and as follows:

1. Upper Curtain, Mesh: Woven fabric of 100 percent polyester yarn coated with PVC weighing not less than 6.5 oz./sq. yd.
    a. Mesh Color: White.
2. Lower Curtain, Solid: Woven polyester coated with PVC, minimum 18 oz./sq. yd, embossed, 8-foot height above floor.
    a. Fabric Color: As selected by Architect from manufacturer's full range.
3. Top Hem: Reinforce with double thickness mesh for grommets and continuous pipe batten.

C. Accessories:

1. Grommets: Manufacturer's standard size and spacing, for snaps or S-hooks.
2. Proof Coil Chain: Grade 30, No. 8, zinc plated, 3/16 inch, ASTM A 413.
3. Curtain Battens: Fabricate battens from steel pipe with a minimum number of joints. As necessary for required lengths, connect pipe with drive-fit pipe sleeve not less than 18 inches long, and secure with 4 flush rivets, plug welds, threaded couplings, or another equally secure method. Shop-paint completed pipe battens with black paint.
    a. Steel Pipe: ASTM A 53, Grade A, standard weight (Schedule 40), black, 1-1/2-inch nominal diameter, unless otherwise indicated.

D. Divider Curtain Operator: Drive pipe.

E. Divider Curtain Electric Operator: Provide operating machine of size and capacity recommended by manufacturer for equipment specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, and remote controls. Coordinate wiring requirements and electrical characteristics with building electrical system.
1. Operator Type: Electric motor, enclosed gear-head-reduction drive, with chain and sprocket secondary drive.

F. Motor Characteristics: Sufficient to start, accelerate, reverse, and operate connected loads at designated speeds within installed environment and with indicated operating sequence, and without exceeding nameplate rating or considering service factor. Comply with NEMA MG 1, and the following:
1. Voltage: Coordinate with Electrical Construction Documents.
2. Horsepower: 3/4 hp.
3. Enclosure: Manufacturer's standard.
4. Duty: Continuous duty at ambient temperature of 105 deg F and at altitude of 3300 feet above sea level.
5. Remote-Control Station: Key pad control system; NEMA ICS 6, Type 1 enclosure for recessed or flush mounting.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for alignment of mounting substrates, installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance.
1. Verify critical dimensions.
2. Examine supporting structure.
3. Examine wall assemblies, where reinforced to receive anchors and fasteners, to verify that locations of concealed reinforcements have been clearly marked. Locate reinforcements and mark locations.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written installation instructions. Complete field assembly, where required.

B. Unless otherwise indicated, install gymnasium dividers after other finishing operations, including painting, have been completed.

C. Gymnasium Divider and Components: Rigid, level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated on Shop Drawings; in proper relation to adjacent construction; and aligned with court layout.

1. Verify clearances for movable components of gymnasium divider throughout entire range of operation and for access to operating components.

D. Connections: Connect automatic operators to building electrical system.

3.03 ADJUSTING

A. Adjust movable components of gymnasium divider to operate safely, smoothly, easily, and quietly, free from binding, warp, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and moving parts.

B. After completing gymnasium divider installation, inspect components. Remove spots, dirt, and debris and touch up damaged shop-applied finishes according to manufacturer's written instructions.

C. Replace gymnasium divider components and finishes that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

3.04 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain gymnasium divider. Refer to Division 1 Section "Demonstration and Training."

END OF SECTION

SECTION 11 6813
MODULAR PLAYGROUND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General Conditions and Supplementary Conditions and Division 1 Specification Sections, apply to the Work of this Section.

1.02 RELATED WORK

A. Section 02300 "Earthmoving”

1.03 DESCRIPTION OF WORK

A. This Section shall be used as a standard of quality for equipment. Actual types of apparatus shall be noted on the drawings.

B. Provide and install modular playground structure, complete with all play components, fasteners, supports and footings, ground cover and timber edging. Locate in area indicated on Drawings. Provide ground cover and edging in profile and extent as indicated.

1.04 QUALITY ASSURANCE

A. Safety Requirements: Design playground components to avoid snagging of clothing and entrapment of hands, arms, or other body parts. Equipment shall conform to the following:

1. US Consumer Product Safety Commission (US CPSC) Guidelines: Handbook for Public Playground Safety.

B. Single Source Responsibility: All playground components and accessories shall be supplied by one manufacturer.

C. Erection of the equipment shall be performed by an installer authorized and approved by the Manufacturer.

1.05 SUBMITTALS

A. Product Data: Submit Manufacturer's technical data for materials, including catalog information for major components, anchors, fasteners and other accessories along with information on finishes. Provide Manufacturer's standard installation procedures.

1. Submit recycled-content data, designating percentages of post-consumer and post-industrial recycled material.

B. Shop Drawings: Submit shop drawings indicating layout of specified components, details for anchoring and fastening of individual components, details of support and foundations, and any other fabrication or erection information not fully described by the product literature.

1.06 WARRANTIES

A. Provide Manufacturer's standard warranty on main support components to cover structural failure due to corrosion, deterioration or defects in workmanship.

B. Provide Manufacturer's standard one (1) year warranty covering defects in materials and workmanship for playground components except as noted below:

1. Structural (Main Components): ten (10) years

2. Plastic: five (5) years

PART 2 – PRODUCTS:

2.01 APPROVED MANUFACTURERS

A. Iron Mountain Forge KB 26996 Modular Playground Unit shall be the basis of this Specification.

B. Game Time "Power Scape" (Fort Payne, AL).

C. Other manufacturers meeting the requirements of this Section, and subject to the approval process outlined in Specifications, shall be acceptable. Manufacturers using recycled plastic components include:

1. Amazing Recycled Products, Inc., Denver, CO, 800-241-2174, www.amazingrecycled.com
2. Children's Playstructures, Inc., Littleton, CO, 800-874-9943, www.childrensplaystructures.com
3. Landscape Structures Inc., Delano, MN, 888-438-6574, www.playlsi.com
4. Playworld Systems, Lewisburg, PA, 800-233-8404, www.playworldsystems.com
5. Recreation Creations, Inc., Hillsdale, MI, 800-766-9458, www.rec-creations.com
6. The Plastic Lumber Co., Akron, OH, 800-886-8990, www.plasticlumber.com

2.02 MATERIALS

A. General Design Requirements

1. Straight Slides (including pipe slides) without transition sections at the base of the slide shall not exceed 30 degrees of incline. Slide "fall zones" shall comply with US CPSC guidelines.
2. Provide adequate "no encroachment zone" around entire perimeter of playground area.
3. Overall height of equipment shall not exceed 6'-6", except for fireman's poles which shall not exceed 10 feet in height.
4. Fastening, Fabrication and Finish details: Protruding bolts, sharp or jagged edges, non-capped open-ended pipes or other openings shall not be acceptable. Piping or other supports shall not extend more than 2" beyond a locking collar.
5. Foundations: The minimum specifications for the diameter, depth and excavation of footings shall be as follows:
    a. Poles up to and including 6" in diameter: 12" in diameter and 3 feet in depth.
    b. Poles exceeding 6" in diameter: Diameter shall be twice the pole diameter and 3 feet in depth.

B. Ground Cover and Drainage: Provide treated wood mulch over the entire area indicated on the drawings, to a minimum depth of 12". Coordinate with drawings to ensure adequate drainage under the ground cover, and to avoid ponding. Maximum allowable slope shall be 2%.

1. Acceptable ground covers: "Surflex", "Fibar", "Wood Carpet", or approved equal.

C. Edging: Provide timber border around entire perimeter. Timber shall be pressure treated for ground contact with non-CCA treatment materials (0.40 #2 or better; ACQ is an acceptable wood treatment)); recycled and/or creosoted timber shall not be acceptable.

1. All edges shall be 1/2" radius.
2. All lumber shall be free from splinters.
3. Two tiers of lumber shall be provided with rowlock or half-lapped joints. Bottom tier of lumber shall be staked to the ground with steel rods reinforcing bars, 1/2" round, 36" on center, and 24" deep.
4. Top and bottom tiers shall be spiked together using galvanized fasteners.

D. Support Posts: 5" O. D., 11 gauge minimum galvanized steel with plastic coated end caps.

E. Fasteners: Provide self-locking nuts or other devices to prevent loosening of assemblies. All fasteners shall be galvanized, cadmium plated, or otherwise treated to prevent rusting.

F. Metal Decks: Perforated, non-skid.

G. Fireman's Pole (Sliding Pole): Fabricated from 1 5/8" O. D. galvanized steel pipe.

H. Spiral Slide: Polyethylene composition with the following features:

1. Center Tube: 3 1/2" O. D. 11 gauge minimum galvanized steel.

2. Front Leg: 1 1/2" O. D. 11 gauge minimum galvanized steel.

3. Slide shall rest flush on the upper platform.

I. "Ring Trek" Traveling Rings: Provide six (6) high tensile strength aluminum rings, plastic coated, with swivel joint and clamp attachment to supports. Beam: 2 3/8" O. D., galvanized.

J. "Curly" Climber:

1. General: Climber shall have no gaps greater than 3 1/2", and less than 9" between coils. Design shall not allow passage of children into the interior of the coil.

2. Coils shall be fabricated from not less than 1 5/6" O. D. galvanized steel pipe.

3. Center support post shall be fabricated from not less than 1 5/8" O. D. galvanized steel pipe.

K. Double Wide Plastic Slide: Single piece, UV stabilized molded polyethylene with average thickness of 5/16" and integral color. Sides shall be 8" high above the slide surface; center divider shall not have gaps. Width of slide bedway shall be 16" minimum.

L. Horizontal "Challenge" Ladder: 2 3/8" O. D. galvanized plastic-covered outside rails, with eight (8) rungs consisting of 1 1/4" O. D. galvanized steel welded to the rails at 12" on center.

M. Arched Chain Climber: One-piece, all welded construction. Side rails shall be 1 5/8" O.C. galvanized steel pipe, arched, and spaced 30" center to center. Chain: 4/0 steel with oven cured PVC "no pinch coating"; or galvanized coating.

N. Recycled-plastic: Recycled HDPE or other recycled plastic components may be used if approved in advance by PGCPS.

PART 3 – EXECUTION:

3.01 INSPECTION

A. Installer and Owner's Representative shall examine the area and conditions under which the playground equipment will be installed. Do not proceed until all conditions, which would be detrimental to the installation, are corrected.

3.02 INSTALLATION

A. General: Install the playground equipment in accordance with the Manufacturer's recommended procedures and installation sequence. All equipment shall be rigid, straight, plumb and level. Secure all equipment with Manufacturer's fastening devices.

B. Foundations: All support holes shall be filled with concrete to the full-required depth. The top of the concrete shall be 6" below finished grade. All primary supports shall be temporarily supported until concrete has sufficiently cured.

C. Secure timber edging in place by spiking as specified herein. Rods shall not protrude beyond the face of the timber.

D. Fasteners: All in-place bolts shall be cut flush with the nut, and peened and filed. Self- locking nuts or other devices must be provided to prevent nut and bolt assemblies from loosening or coming apart.

E. Welds: Ensure that all welds are protected with rust inhibiting paint.

F. Metal Connectors: Secure with pins or spot welding to prevent loosening of the connection.

3.03 CLEAN-UP

A. Remove all debris, excess materials, tools and excess excavation spoils from the project area and dispose of legally.

3.04 WASTE MANAGEMENT:

A. Recycle waste materials in accordance with Division 1 “Construction Waste Management” requirements.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Horizontal slat louver blinds.

B. Operating hardware.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

B. Section 10 7113 - Exterior Sun Control Devices: Exterior horizontal louver blinds.

C. Section 12 2116 - Vertical Louver Blinds.

1.03 PRICE AND PAYMENT PROCEDURES

A. Allowances: See Section 01 2100 - Allowances, for cash allowances affecting this section.

1.04 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. WCMA A100.1 - Safety of Window Covering Products 2018.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the placement of concealed blocking to support blinds. See Section 06 1000.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating physical and dimensional characteristics.

C. Shop Drawings: Indicate opening sizes, tolerances required, method of attachment, clearances, and operation.

D. Samples: Submit two samples illustrating slat materials and finish, cord type and color.

E. Manufacturer's Installation Instructions: Indicate special procedures.

F. Maintenance Materials: Furnish the following for Owner 's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Blind Assemblies: One of each size.
3. Extra Slats: 20 of each type and size.
4. Extra Lift Cords, Control Cords, and Wands: One of each type.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Horizontal Louver Blinds:

1. Substitutions: See Section 01 6000 - Product Requirements.

B. Horizontal Louver Blinds With Side Guides:

1. Basis of Design: Draper, Inc; Venetian Blinds by Warema; www.draperinc.com/#sle.
2. Other Acceptable Manufacturers:
3. Substitutions: See Section 01 6000 - Product Requirements.

C. Source Limitations: Furnish blinds and associated controls produced by a single manufacturer and obtained from a single supplier.

2.02 BLINDS

A. Description: Horizontal slat louvers hung from full-width headrail with full-width bottom rail.

B. Manual Operation: Control of raising and lowering by cord with full range locking; blade angle adjustable by control wand.

C. Metal Slats: Spring tempered pre-finished aluminum; square slat corners, with manufacturing burrs removed.

1. Width: 2 inch (50 mm).
2. Color: As selected by Architect.

D. Wood Slats: square slat corners.

1. Width: 2 inch (50 mm).
2. Pre-finished, color as selected by Architect.

E. Slat Support: Woven polypropylene cord, ladder configuration.

F. Head Rail: Pre-finished, formed aluminum box, with end caps; internally fitted with hardware, pulleys, and bearings for operation; same depth as width of slats.

1. Color: Same as slats.

G. Bottom Rail: Pre-finished, formed steel; with end caps.

1. Color: Same as headrail.

H. Lift Cord: Braided nylon; continuous loop; complying with WCMA A100.1.

1. Free end weighted.
2. Color: As selected by Architect.

I. Control Wand: Extruded hollow plastic; hexagonal shape.

1. Non-removable type.
2. Length of window opening height less 3 inch (76 mm).
3. Color: Clear.

J. Headrail Attachment: Wall brackets.

K. Accessory Hardware: Type recommended by blind manufacturer.

2.03 BLINDS WITH SIDE GUIDES

A. Description: Horizontal slat louvers hung from full-width headrail with full-width bottom rail and side guides for slat stability.

B. Manual Operation: Control of raising, lowering, and tilting blades by crank operator. Gear box concealed in headrail; fixed handle.

C. Headrail: Extruded aluminum, size according to length of drop of blinds.

D. Headrail Box: Custom fabricated sheet aluminum box to protect blinds in raised position. Size as required to cover stack of retracted blinds.

E. Bottom Rail: Extruded aluminum with plastic end caps, size according to width of slat.

F. Metal Slats: Pre-finished aluminum; square slat corners, with manufacturing burrs removed.

1. Width: 2 inch (50 mm).

G. Slat Support: Heavy-duty, tear-resistant terylene yarn, ladder configuration.

H. Side Guides:

1. Extruded aluminum side channels with plastic inserts.

I. Headrail Attachment: Direct-mounted.

J. Finish/Color:

1. Other exposed aluminum components: Color to match slats.

2.04 FABRICATION

A. Determine sizes by field measurement.

B. At openings requiring multiple blind units, provide separate blind assemblies with space as specified by architect between blinds, located at window mullion centers.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings are ready to receive the work.

B. Ensure structural blocking and supports are correctly placed. See Section 06 1000.

3.02 INSTALLATION

A. Install blinds in accordance with manufacturer's instructions.

B. Secure in place with flush countersunk fasteners.

3.03 TOLERANCES

A. Maximum Variation of Gap at Window Opening Perimeter: 1/4 inch (6 mm).

B. Maximum Offset From Level: 1/8 inch (3 mm).

3.04 ADJUSTING

A. Adjust blinds for smooth operation.

3.05 CLEANING

A. Clean blind surfaces just prior to occupancy.

B. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes room darkening roller shades and motorized shade operators.

1. Location of manual or electrical shades as indicated on Drawings.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions.

1. Motorized Shade Operators: Include operating instructions.
2. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.

B. Shop Drawings: Show location and extent of roller shades. Include elevations, sections, details, and dimensions not shown in Product Data. Show installation details, mountings, attachments to other work, operational clearances, and relationship to adjoining work.

1. Motorized Shade Operators: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
2. Wiring Diagrams: Power, system, and control wiring.

C. Samples for Initial Selection: For each colored component of each type of shade indicated.

1. Include similar Samples of accessories involving color selection.

D. Samples for Verification:

1. Complete, full-size operating unit not less than 16 inches wide for each type of roller shade indicated.
2. For the following products:
    a. Shade Material: Not less than 3 inches square, with specified treatments applied. Mark face of material.
    b. Fascia: Full-size unit, not less than 12 inches long.
    c. Complete parts box containing motorized shade hardware.

E. Product Certificates: For each type of roller shade, signed by product manufacturer.

F. Qualification Data: For Installer.

G. Product Test Reports: For each type of roller shade.

H. Maintenance Data: For roller shades to include in maintenance manuals. Include the following:

1. Methods for maintaining roller shades and finishes.
2. Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.
3. Operating hardware.
4. Motorized shade operator.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed installation of roller shades similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction

with a record of successful in-service performance.

B. Source Limitations:

1. Obtain roller shades through one source from a single manufacturer.

2. To control the responsibility for performance of motorized roller shade systems, assign the design, engineering, and installation of motorized roller shade systems, motors, controls, and low voltage electrical control wiring specified in this Section to a single manufacturer and their authorized installer/dealer. The Architect will not produce a set of electrical drawings for the installation of control wiring for the motors, or motor controllers of the motorized roller shades. Power wiring (line voltage), shall be provided by the roller shade installer/dealer, in accordance with the requirements provided by the manufacturer. Coordinate the following with the roller shade installer/dealer:

a. Contractor shall provide power panels and circuits of sufficient size to accommodate roller shade manufacturer’s requirements, as indicated on the Electrical Drawings.

b. Contractor shall coordinate with requirements of roller shade installer/dealer, before inaccessible areas are constructed.

c. Roller shade installer/dealer shall run line voltage as dedicated home runs (of sufficient quantity, in sufficient capacity as required) terminating in junction boxes in locations designated by roller shade dealer.

d. Roller shade installer/dealer shall provide and run all line voltage (from the terminating points) to the motor controllers, wire all roller shade motors to the motor controllers, and provide and run low voltage control wiring from motor controllers to switch/ control locations designated by the Architect. All above-ceiling and concealed wiring shall be plenum-rated, or installed in conduit, as required by the electrical code having jurisdiction.

e. Contractor shall provide conduit with pull wire in all areas, which might not be accessible to roller shade contractor due to building design, equipment location or schedule.

C. Fire-Test-Response Characteristics: Provide roller shade band materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Flame-Resistance Ratings: Passes NFPA 701.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Product Standard: Provide roller shades complying with WCMA A 100.1.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in factory packages, marked with manufacturer and product name and location of installation.

1.05 PROJECT CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Store, handle, protect and install absorptive materials, including fabrics materials, in accordance with the Construction IAQ Management Plan required by Division 1 specifications.

C. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating

range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.06 WARRANTY

A. Motorized Components (exclusive of shade motors and motor logic control systems and components): Twenty-five Years Fit for (intended) use per published terms and conditions, from the Date of Substantial Completion and contain provisions that installation is to remain operational without fault for the warranty period; and, include all operating parts, including shade band.

B. Shade motors and motor logic control systems: Five years from Date of Substantial Completion for shade motors and motor logic control systems and components. Motorized shade installation will remain operational without fault for the warranty period and include all operational parts.

C. Installation: Provide roller shade installer's warranty that installation shall be free of defects for a period of not less than 1 year.

D. In the event of a warranted product failure, the roller shade installer will, at no cost to Owner, facilitate acquisition and delivery of all necessary components to the Owner. Owner will provide roller shade dealer/installer with direct access to the work, during dealer/installer's normal business hours.

1.07 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Rollers Shades: Before installation begins, for each size, color, texture, and pattern indicated, full-size units equal to 5 percent of amount installed, or portion thereof.

2. Shade Motors: 5 additional.

PART 2 - PRODUCTS

2.01 ROLLER SHADES

A. Basis-of-Design Products:

1. Roller Shades: Subject to compliance with requirements, provide MechoShade and ElectroShade by MechoShade Systems or equivalent products by Draper or Lutron.

B. Shade Bands: Construction of shade band includes the fabric, the hem weight, hem-pocket, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable.

1. Hem Pockets and Hem Weights: Fabric hem pocket with RF-welded seams (including welded ends) and concealed hem weights. Hem weights shall be of appropriate size and weight for shade band. Hem weight shall be continuous inside a sealed hem pocket. Hem pocket construction and hem weights shall be similar, for all shades within one room.

2. Shade band and Shade Roller Attachment:

a. Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection. Roller tubes less than 1.55 inch in diameter for manual shades, and less than 2.55 inches for motorize shades are not acceptable.

b. Provide for positive mechanical engagement with drive / brake mechanism.

C. Access and Material Requirements:

1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing hardware from opening and without requiring end or center supports to be removed.

2. Provide shade hardware that allows for removal and re-mounting of the shade bands without having to remove the shade tube, drive or operating support brackets.
3. Use only Delrin engineered plastics by DuPont for all plastic components of shade hardware. Styrene based plastics, and /or polyester, or reinforced polyester will not be acceptable.

D. Shade Brackets: Provide shade hardware constructed of minimum 1/8-inch thick plated steel, or heavier, thicker, as required to support 150 percent of the full weight of each shade.

E. Motorized Shade Hardware and Shade Brackets:
1. Provide shade hardware constructed of minimum 1/8-inch thick plated steel, or heavier, thicker, as required to support 150 percent of the full weight of each shade.
2. Provide shade hardware system that allows for field adjustment of motor or replacement of any operable hardware component without requiring removal of brackets, regardless of mounting position (inside, or outside mount).
3. Basis-of-Design: ElectroShade II; six-sided box units for recessed installation with bottom slot opening.

F. Manual Shade Bracket: Mecho/5.

G. Fascia: Provide where indicated on Drawings.
1. Continuous removable extruded aluminum fascia that attaches to shade mounting brackets without the use of adhesives, magnetic strips, or exposed fasteners.
2. Fascia shall be able to be installed across two or more shade bands in one piece.
3. Fascia shall fully conceal brackets, shade roller and fabric on the tube.
4. Provide bracket / fascia end caps where mounting conditions expose outside of roller shade brackets.

H. Mounting: Wall extension brackets mounting permitting easy removal and replacement without damaging roller shade or adjacent surfaces and finishes.

I. Shade Operation - Motorized operator: Locations indicated.
1. Shades for each area shall function as one group; all shades and all sides raising and lowering simultaneous, as Thermoveil Shadecoloth.
2. Shades on same local switch.

2.02 ROLLER SHADE FABRICATION

A. Fabricate units to completely fill existing openings from head to sill and jamb-to-jamb, unless specifically indicated otherwise.

B. Fabricate shadecloth to hang flat without buckling or distortion. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling. Fabricate unguided shadecloth to roll true and straight without shifting sideways more than 1/8 inch in either direction per 8 feet of shade height due to warp distortion or weave design. Fabricate hem as follows:
1. Concealed hem tube (Translucent Shades).

C. Provide battens in standard shades as required to assure proper tracking and uniform rolling of the shadebands. Contractor shall be responsible for assuring the width-to-height (W:H) ratios shall not exceed manufacturer's standards or, in absence of such standards, shall be responsible for establishing appropriate standards to assure proper tracking and rolling of the shadecloth within specified standards. Battens shall be roll-formed stainless steel or tempered steel, as required.

2.03 MANUAL OPERATED CHAIN DRIVE HARDWARE AND BRACKETS

A. Provide for universal, regular and offset drive capacity, allowing drive chain to fall at front, rear or non-offset for all shade drive end brackets. Universal offset shall be adjustable for future change.

B. Provide hardware capable for installation of a removable fascia, for both regular and/or reverse roll, which shall be installed without exposed fastening devices of any kind.

C. Provide shade hardware system that allows for removable regular and/or reverse roll fascias to be mounted continuously across two or more shade bands without requiring exposed fasteners of any kind.

D. Provide positive mechanical engagement of drive mechanism to shade roller tube. Friction fit connectors for drive mechanism connection to shade roller tube are not acceptable

E. Provide shade hardware constructed of minimum 1/8-inch (3.18 mm) thick plated steel or heavier as required to support 150 percent of the full weight of each shade.

F. Drive Bracket / Brake Assembly:

1. The braking mechanism shall be applied to an oil-impregnated hub on to which the brake system is mounted. The oil impregnated hub design includes an articulated brake assembly, which assures a smooth, non-jerky operation in raising and lowering the shades. The assembly shall be permanently lubricated. Products that require externally applied lubrication and or not permanently lubricated are not acceptable.

2. The entire assembly shall be fully mounted on the steel support bracket, and fully independent of the shade tube assembly, which may be removed and reinstalled without effecting the roller shade limit adjustments.

G. Drive Chain: #10 qualified stainless steel chain rated to 90 lb. (41 kg) minimum breaking strength. Nickel plate chain shall not be accepted.

2.04 MOTORIZED ROLLER SHADE OPERATORS

A. Basis-of-Design Product: Specifications and design of shade motors and motor control system are based on the IQ/MLC motor logic control system manufactured by MechoShade Systems, Inc. Other systems may be acceptable provide that all of the following performance capabilities are provided. Motor logic control systems not in complete compliance with these performance criteria shall not be accepted as equal systems.

B. General: Provide factory-assembled motorized shade operation systems designed for lifting shades of type, size, weight, construction, use, and operation frequency indicated. Provide operation systems of size and capacity and with features, characteristics, and accessories suitable for Project conditions and recommended by shade manufacturer, complete with electric motors and factory-prewired motor controls, remote-control stations, power disconnect switches, enclosures protecting controls and all operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors.

1. Coordinate operator wiring requirements and electrical characteristics with the building electrical system.

C. Comply with NFPA 70.

D. Control Equipment:

1. Provide power to each shade motor via individual 3 conductor line voltage circuits connecting each motor to the relay based motor logic controllers (IQ/MLC).

2. Control system components shall provide appropriate (spike and brown out) over-current protection (+/- 10 percent of line voltage) for each of the four individual motor circuits and shall be rated by UL

or ETL as a recognized component of this system and tested as an integrated system.

3. Control system shall allow for automatic alignment of shade hem bars in stopped position at 25 percent, 50 percent, and 75 percent of opening heights, and up to three user-defined intermediate stopping positions in addition to all up / all down, regardless of shade height, for a total of five positions. Control system shall allow shades to be stopped at any point in the opening height noting that shades may not be in alignment at these non-defined positions).
4. Control system shall have two standard operating modes: Normal mode allowing the shades to be stopped anywhere in the window's opening height and uniform mode, allowing the shades to only be stopped at the predefined intermediate stop positions. Both modes shall allow for all up / all down positioning.
5. Control system shall allow high rpm motors for shades over means of egress doors to be raised by input from building life safety system (at a speed / rpm determined by building code having jurisdiction), in addition to other modes of operation described in this specification.

E. Electric Motors: UL-approved or -recognized, totally enclosed, insulated motor, complying with NEMA MG 1, with thermal-overload protection, brake, permanently lubricated bearings, and limit switches; sized by shade manufacturer to start and operate size and weight of shade considering service factor or considering Project's service conditions without exceeding nameplate ratings.

1. Service Factor: According to NEMA MG 1, unless otherwise indicated.
2. Motor Characteristics: Single phase, 110 V, 60 Hz.
3. Motor Mounting: Within manufacturer's standard roller enclosure.

F. Remote Controls: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following devices for remote-control activation of shades:

1. Control Stations:
   a. Three-button architectural flush mounted switches with metal cover plate and no exposed fasteners.
   b. Connect local wall switches to control system components via low voltage (12V DC) 4-conductor modular cable equipped with RJ-11 type connectors supplied, installed and certified under Division 16 - Electrical.

2.05 SHADE CLOTH

A. Translucent Single-Fabric Shadecloth: MechoShade Systems, Inc., EcoVeil group, 100 percent thermoplastic olefin.

1. Shading:
   a. Roller Shades: EcoVeil "1550 Series", 3 percent open.

B. Color: Selected from manufacturer's standard colors.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions. Allow clearances for window operation hardware.

B. Connections: Connect motorized operators to building electrical system.

3.03 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.04 CLEANING AND PROTECTION

A. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.05 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain roller shades.

END OF SECTION

SECTION 12 24 13
ROLLER SHADES
Display hidden notes to specifier. (Don't know how? Click Here)

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Sunscreen roller shades.

B. Room darkening roller shades.

C. Room darkening and sunscreen double roller shades.

D. Zipper shade system with side channels.

1.2 RELATED SECTIONS

A. Section 06 10 00 - Rough Carpentry: Wood blocking and grounds for mounting roller shades and accessories.

B. Section 09 21 16 - Gypsum Board Assemblies: Coordination with gypsum board assemblies for installation of shade pockets, closures and related accessories.

C. Section 09 51 00 - Acoustical Ceilings: Coordination with acoustical ceiling systems for installation of shade pockets, closures and related accessories.

D. Division 16 - Electrical: Electric service for motor controls.

1.3 REFERENCES

A. ASTM G 21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

B. NFPA 70 - National Electrical Code.

C. NFPA 701 - Fire Tests for Flame-Resistant Textiles and Films.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 30 00.

B. [Product Data]: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.
3. Storage and handling requirements and recommendations.
4. Mounting details and installation methods.
5. Typical wiring diagrams including integration of motor controllers with building management system, audiovisual and lighting control systems as applicable.

C. Shop Drawings: Plans, elevations, sections, product details, installation details, operational

clearances, wiring diagrams and relationship to adjacent work.
1. Prepare shop drawings on Autocad or Microstation format using base sheets provided electronically by the Architect.

D. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings and include opening sizes and key to typical mounting details.

E. Selection Samples: For each finish product specified, one set of shade cloth options and aluminum finish color samples representing manufacturer's full range of available colors and patterns.

F. Verification Samples: For each finish product specified, one complete set of shade components, unassembled, demonstrating compliance with specified requirements. Shadecloth sample and aluminum finish sample as selected. Mark face of material to indicate interior faces.

G. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Obtain roller shades through one source from a single manufacturer with a minimum of twenty years experience in manufacturing products comparable to those specified in this section.

B. Installer Qualifications: Installer trained and certified by the manufacturer with a minimum of ten years experience in installing products comparable to those specified in this section.

C. Fire-Test-Response Characteristics: Passes NFPA 701 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.

D. Electrical Components: NFPA Article 100 listed and labeled by either UL or ETL or other testing agency acceptable to authorities having jurisdiction, marked for intended use, and tested as a system. Individual testing of components will not be acceptable in lieu of system testing.

E. Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642, ATCC 9644, ATCC9645.

F. Mock-Up: Provide a mock-up (manual shades only) of one roller shade assembly for evaluation of mounting, appearance and accessories.
1. Locate mock-up in window designated by Architect.
2. Do not proceed with remaining work until, mock-up is accepted by Architect.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in the Window Treatment Schedule.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.8 WARRANTY

A. Roller Shade Hardware and Chain Warranty: Manufacturer's standard non-depreciating twenty-five year limited warranty.

B. Standard Shadecloth: Manufacturer's standard twenty-five year warranty.

C. Ecoveil Shadecloth: Manufacturer's standard ten year warranty.

D. Roller Shade Motors and Motor Control Systems: Manufacturer's standard non-depreciating five year warranty.

E. Roller Shade Installation: One year from date of Substantial Completion, not including scaffolding, lifts or other means to reach inaccessible areas.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Mecho, which is located at: 42-03 35th St.; Long Island City, NY 11101; Tel: 718-729-2020; Fax: 718-729-2941; Email: communications@mechoshade.com; http://www.mechoshade.com

B. Substitutions: Not permitted.

C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

D. Alternates: The following products and manufacturers may be bid as an alternate product in accordance with Section 01 23 00 - Alternates. Any pricing for alternate products shall be listed separately from the base bid specified product. Any alternate pricing must include line-by-line compliance or non-compliance with the specifications. If the alternate product is acceptable to the Architect, the specified manufacturer will be given the opportunity to provide an equivalent proposal.
1. Suburban/2 Shade System by Mecho.
2. ((List other manufacturer or product here.))

2.2 ROLLER SHADE TYPE AND SHADECLOTH

A. Manually Operated Shades:
1. Mounting: Surface mounted.
2. Mounting: Surface mounted with pocket.
3. Mounting: Surface mounted with fascia.
4. Mounting: Recess mounted with ceiling pocket.
5. Mounting: Recess mounted without ceiling pocket.
6. Configuration: Single solar shadecloth.
7. Configuration: Single blackout shadecloth.
8. Configuration: Double solar and blackout shadecloth.
9. Solar Shadecloths:
   a. Fabric: ThermoVeil 0900, 0-1 percent visually translucent extra-dense linear weave pattern.
   b. Fabric: ThermoVeil 1000, 2-3 percent open, dense linear-weave pattern.
   c. Fabric: ThermoVeil 1300, 5 percent open, 2 by 2 dense basket-weave pattern, colors match 1500 (3 percent open), also 126 inches (3200 mm) wide.
   d. Fabric: ThermoVeil 1500, 3 percent open, 2 by 2 dense basket-weave pattern, colors match 1300 (5 percent open), also 126 inches (3200 mm) wide.
   e. Fabric: ThermoVeil 2100, 10 percent open, 2 by 2 open basket-weave pattern, colors match 1300 (5 percent open) and 1500 (3 percent open).
   f. Fabric: ThermoVeil 3000 satin, twill-weave pattern at 1 to 2 percent open, with

an alternating predominant color in the warp and weft (fill). Reverse side can be used facing interior if specified.

g. Fabric: ThermoVeil 3200 satin twill weave pattern at 1 to 2 percent open, with an alternating predominant color in the warp and weft (fill). Reverse side can be used facing interior if specified.
h. Fabric: ThermoVeil 3300 diamond earthtone twill-weave pattern at 1 to 2 percent open, with an alternating predominant color in the warp and weft (fill). Reverse side can be used facing interior if specified.
i. Fabric: EuroVeil 5300, thin, fine, screen cloth in broad range of colors in basket weave pattern at 5 percent open.
j. Fabric: EuroTwill 6000, finely woven Reversible Weave at 3 percent open. Reverse side can be used facing interior if specified.
k. Fabric: EuroTwill 6200, distinctive, tightly woven twill design, comprised of fine polyester with PVC coating at 1 to 2 percent open. Reverse side can be used facing interior if specified.
l. Fabric: EuroTwill 6450, a broke twill-weave design comprised of fine polyester with PVC coating at 3 percent open. Reverse side can be used facing interior if specified.
m. Fabric: EcoVeil 0950, TPO Cradle to Cradle Certified, fabric, non-PVC, 1 x 1 basket-weave pattern at 1 percent open. Colors match 1350 (5 percent open) and 1550 (3 percent open).
n. Fabric: EcoVeil 1350, TPO Cradle to Cradle Certified, fabric, non-PVC, 1 x 1, basket-weave pattern at 5 percent open. Colors match 0950 (1 percent open) and 1550 (3 percent open).
o. Fabric: EcoVeil 1550, TPO fabric, Cradle to Cradle Certified, non-PVC, 1 x 1, basket-weave pattern at 3 percent open. Colors match 0950 (1 percent open) and 1350 (5 percent open).
p. Fabric: SoHo 1100, (1 percent open), 2 x 2 basket-weave pattern of fine yarn PVC and polyester blend, same colors as in 1600 (3 percent open) and 1900 series, (5 percent open).
q. Fabric: SoHo 1600, (3 percent open), 2 x 2 basket-weave pattern of fine yarn PVC and polyester blend, same colors as in 1100 (1 percent open) and 1900 series, (5 percent open).
r. Fabric: SoHo 1900, (5 percent open), 2 x 2 basket-weave pattern of fine yarn, PVC and polyester blend, same colors as in 1100 (1 percent open) and 1600 series, (3 percent open).
s. Fabric: EcoVeil Sheer 6750, Cradle to Cradle Certified, woven 100 percent polyester, PVC-free, reversible face, (3 percent open). The first shadecloth to pass NFPA 701 flame tests without added chemical flame retardants.
t. Fabric: EcoVeil Sheer 6850, Cradle to Cradle Certified, woven 100 percent polyester, PVC-free, reversible face, (1 percent open). The first shadecloth to pass NFPA 701 flame tests without added chemical flame retardants.
u. Color: Selected from manufacturer's standard colors.
v. Color: Custom color.

10. Blackout Shadecloths:
    a. Fabric: Classic Blackout 0700, Vinyl coated fabric blackout material same color reverse side (for exterior).
    b. Fabric: ThermoVeil Equinox 0100, blackout shadecloth with opaque acrylic backing, PVC-free, white color reverse side (for exterior). Available 98 inch (24789 mm).
    c. Fabric: Midnite 200, blackout shadecloth with opaque acrylic backing. PVC-free, white color reverse side (for exterior), available 126 inch wide.
    d. Fabric: Distinctive Blackout 0800, blackout shadecloth with laminated 2 x 2 basket weave, opaque fiberglass base with Vinyl coating, heavy-weight construction, white color reverse side (for exterior).
    e. Fabric: Duplex blackout 0250, blackout shadecloth with opaque foam backing

and base polyester cloth, PVC-free, graphite color reverse side (for exterior). Available in 118 inches (2997 mm) wide.

f. Color: Selected from manufacturer's standard colors.

g. Color: Custom color.

11. Specialty Shadecloths:

a. Fabric: ThermoVeil Mirrofilm 0600, transparent, light filtering and heat insulating material

b. Fabric: AcoustiVeil 0890, dimout, 0-1 percent open, fabric, sound-absorbing, with noise reduction coefficient (NRC) of 0.575, to aid in reducing echoes, polyester, PVC-free with a Declare label.

12. Mecho5x, Managed Lift Force, Hardware: Lifts single band or multiband shade assemblies:

a. Lifting Force: 3.5 to 8.5 pounds (1.6 to 3.9 kg) for shade assemblies with a shade band hanging weight, not including mounting hardware, of 35 pounds (16 kg).

b. Backward compatible to Mecho-5 components including facia, regular and reverse roll, pockets, and wall-mounting accessories.

c. Includes offset drive capability, left/right, front, or back to allow for utilization of blackout or ShadeLoc Zipper channels.

d. Allows for ease of operation when obstructions do not allow for direct drive chain access.

e. Offset chain drive shall not cause an increase of friction or pull force when operated up to a 26 degree angle from vertical.

B. Motorized Shades:

1. Mounting: Surface mounted.
2. Mounting: Surface mounted with pocket.
3. Mounting: Surface mounted with fascia.
4. Mounting: Recess mounted with ceiling pocket.
5. Mounting: Recess mounted without ceiling pocket or fascia.
6. Configuration: Single solar shadecloth.
7. Configuration: Single blackout shadecloth.
8. Configuration: Double solar and blackout shadecloth.
9. Solar Shadecloths:

a. Fabric: ThermoVeil 0900, 0 to 1 percent visually translucent extra-dense linear weave pattern.

b. Fabric: ThermoVeil 1000, 2 to 3 percent open, dense linear-weave pattern.

c. Fabric: ThermoVeil 1300, 5 percent open, 2 by 2 dense basket-weave pattern, colors match 1500 (3 percent open), also 126 inches (3200 mm) wide.

d. Fabric: ThermoVeil 1500, 3 percent open, 2 by 2 dense basket-weave pattern, colors match 1300 (5 percent open), also 126 inches (3200 mm) wide.

e. Fabric: ThermoVeil 2100, 10 percent open, 2 by 2 open basket-weave pattern, colors match 1300 (5 percent open) and 1500 (3 percent open).

f. Fabric: ThermoVeil 3000 satin, twill-weave pattern at 1 to 2 percent open, with an alternating predominant color in the warp and weft (fill). Reverse side can be used facing interior if specified.

g. Fabric: ThermoVeil 3200 satin twill weave pattern at 1 to 2 percent open, with an alternating predominant color in the warp and weft (fill). Reverse side can be used facing interior if specified.

h. Fabric: ThermoVeil 3300 diamond earthtone twill-weave pattern at 1 to 2 percent open, with an alternating predominant color in the warp and weft (fill). Reverse side can be used facing interior if specified.

i. Fabric: EuroVeil 5300, thin, fine, screen cloth in broad range of colors in basket weave pattern at 5 percent open.

j. Fabric: EuroTwill 6000, finely woven Reversible Weave at 3 percent open. Reverse side can be used facing interior if specified.

k. Fabric: EuroTwill 6200, distinctive, tightly woven twill design, comprised of fine polyester with PVC coating at 1 to 2 percent open. Reverse side can be used facing interior if specified.
l. Fabric: EuroTwill 6450, a broke twill-weave design comprised of fine polyester with PVC coating at 3 percent open. Reverse side can be used facing interior if specified.
m. Fabric: EcoVeil 0950, TPO Cradle to Cradle Certified, fabric, non-PVC, 1 x 1 basket-weave pattern at 1 percent open. Colors match 1350 (5 percent open) and 1550 (3 percent open).
n. Fabric: EcoVeil 1350, TPO Cradle to Cradle Certified, fabric, non-PVC, 1 x 1, basket-weave pattern at 5 percent open. Colors match 0950 (1 percent open) and 1550 (3 percent open).
o. Fabric: EcoVeil 1550, TPO fabric, Cradle to Cradle Certified, non-PVC, 1 x 1, basket-weave pattern at 3 percent open. Colors match 0950 (1 percent open) and 1350 (5 percent open).
p. Fabric: SoHo 1100, (1 percent open), 2 x 2 basket-weave pattern of fine yarn PVC and polyester blend, same colors as in 1600 (3 percent open) and 1900 series, (5 percent open).
q. Fabric: SoHo 1600, (3 percent open), 2 x 2 basket-weave pattern of fine yarn PVC and polyester blend, same colors as in 1100 (1 percent open) and 1900 series, (5 percent open).
r. Fabric: SoHo 1900, (5 percent open), 2 x 2 basket-weave pattern of fine yarn, PVC and polyester blend, same colors as in 1100 (1 percent open) and 1600 series, (3 percent open).
s. Fabric: EcoVeil Sheer 6750, Cradle to Cradle Certified, woven 100 percent polyester, PVC-free, reversible face, (3 percent open). The first shadecloth to pass NFPA 701 flame tests without added chemical flame retardants.
t. Fabric: EcoVeil Sheer 6850, Cradle to Cradle Certified, woven 100 percent polyester, PVC-free, reversible face, (1 percent open). The first shadecloth to pass NFPA 701 flame tests without added chemical flame retardants.
u. Color: Selected from manufacturer's standard colors.
v. Color: Custom color.

10. Blackout Shadecloths:
    a. Fabric: Classic Blackout 0700, Vinyl coated fabric blackout material same color reverse side (for exterior).
    b. Fabric: ThermoVeil Equinox 0100, blackout shadecloth with opaque acrylic backing, PVC-free, white color reverse side (for exterior). Available 98 inch.
    c. Fabric: Midnite 0200, blackout shadecloth with opaque acrylic backing. PVC-free, white color reverse side (for exterior), available 126 inch (3200 mm) wide.
    d. Fabric: Distinctive Blackout 0800, blackout shadecloth with laminated 2 x 2 basket weave, opaque fiberglass base with Vinyl coating, heavy-weight construction, white color reverse side (for exterior).
    e. Fabric: Duplex blackout 0250, blackout shadecloth with opaque foam backing and base polyester cloth, PVC-free, graphite color reverse side (for exterior). Available in 118 inches (2997 mm) wide
    f. Color: Selected from manufacturer's standard colors.
    g. Color: Custom color.
11. Specialty Shadecloths:
    a. Fabric: ThermoVeil Mirrofilm 0600, transparent, light filtering and heat insulating material
    b. Fabric: AcoustiVeil 0890, dimout, 0 to 1 percent open, fabric, sound-absorbing, with noise reduction coefficient (NRC) of 0.575, to aid in reducing echoes, polyester, PVC-free with a Declare label.
12. Controls: Electrically operated, Quiet Intelligent Encoded Motor System.
13. Controls: Electrically operated, IQ/MLC low voltage control system.

2.3 SHADE BAND

A. Shade Bands: Construction of shade band includes the fabric, the hem weight, hem-pocket, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable.
   1. Hem Pockets and Hem Weights: Fabric hem pocket with RF-welded seams (including welded ends) and concealed hem weights. Hem weights shall be of appropriate size and weight for shade band. Hem weight shall be continuous inside a sealed hem pocket. Hem pocket construction and hem weights shall be similar, for all shades within one room.
   2. Shade Band and Shade Roller Attachment:
      a. Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection. Roller tubes less than 1.55 inch (39.37 mm) in diameter for manual shades, and less than 2.55 inches (64.77 mm) for motorize shades are not acceptable.
      b. Provide for positive mechanical engagement with drive / brake mechanism.
      c. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable / replaceable with a "snap-on" "snap-off" spline mounting, without having to remove shade roller from shade brackets.
      d. Mounting spline shall not require use of adhesives, adhesive tapes, staples, and/or rivets.
      e. Any method of attaching shade band to roller tube that requires the use of adhesive, adhesive tapes, staples, and/or rivets are not acceptable.

2.4 SHADE FABRICATION

A. Fabricate units to completely fill existing openings from head to sill and jamb-to-jamb, unless specifically indicated otherwise.

B. Fabricate shadecloth to hang flat without buckling or distortion. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling. Fabricate unguided shadecloth to roll true and straight without shifting sideways more than 1/8 inch (3 mm) in either direction per 8 feet (2438 mm) of shade height due to warp distortion or weave design. Fabricate hem as follows:
   1. Hembar: Concealed hembar.
   2. Hembar: Exposed hembar.
   3. Hembar: Exposed hembar with light seal for blackout shades.
   4. Hembar: Exposed blackout hembar with polybond seal for blackout shades.

C. Provide battens in standard shades as required to assure proper tracking and uniform rolling of the shadebands. Contractor shall be responsible for assuring the width-to-height (W:H) ratios shall not exceed manufacturer's standards or, in absence of such standards, shall be responsible for establishing appropriate standards to assure proper tracking and rolling of the shadecloth within specified standards. Battens shall be roll-formed stainless steel or tempered steel, as required.

D. For railroaded shadebands, provide seams in railroaded multi-width shadebands as required to meet size requirements and in accordance with seam alignment as acceptable to Architect. Seams shall be properly located. Furnish battens in place of plain seams when the width, height, or weight of the shade exceeds manufacturer's standards. In absence of such standards, assure proper use of seams or battens as required to, and assure the proper tracking of the railroaded multi-width shadebands.

E. Provide battens for railroaded shades when width-to-height (W:H) ratios meet or exceed manufacturer's standards. In absence of manufacturer's standards, be responsible for proper use and placement of battens to assure proper tracking and roll of shadebands.

F. Blackout shadebands, when used in side channels, shall have horizontally mounted, roll-formed stainless steel or tempered-steel battens not more than 3 feet (914 mm) on center extending fully into the side channels. Battens shall be concealed in an integrally-colored fabric to match the inside and outside colors of the shadeband, in accordance with manufacturer's published standards for spacing and requirements.
   1. Battens shall be roll formed of stainless steel or tempered steel and concave to match the contour of the roller tube.
   2. Batten pockets shall be self-colored fabric front and back RF welded into the shadecloth. A self-color opaque liner shall be provided front and back to eliminate any see through of the batten pocket that shall not exceed 1-1/2 inches (38 mm) high and be totally opaque. A see-through moire effect, which occurs with multiple layers of transparent fabrics, shall not be acceptable.

2.5 COMPONENTS

A. Access and Material Requirements:
   1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing hardware from opening and without requiring end or center supports to be removed.
   2. Provide shade hardware that allows for removal and re-mounting of the shade bands without having to remove the shade tube, drive or operating support brackets.
   3. Use only Delrin engineered plastics by DuPont for all plastic components of shade hardware. Styrene based plastics, and /or polyester, or reinforced polyester will not be acceptable.

B. Motorized Shade Hardware and Shade Brackets:
   1. Provide shade hardware constructed of minimum 1/8-inch (3 mm) thick plated steel, or heavier, thicker, as required to support 150 percent of the full weight of each shade.
   2. Provide shade hardware system that allows for field adjustment of motor or replacement of any operable hardware component without requiring removal of brackets, regardless of mounting position (inside, or outside mount).
   3. Provide shade hardware system that allows for operation of multiple shade bands offset by a maximum of 8 to 45 degrees from the motor axis between shade bands (4 to 22.5 degrees) on each side of the radial line, by a single shade motor (multi-banded shade, subject to manufacturer's design criteria).

C. Manual Operated Chain Drive Hardware and Brackets, Mecho5x:
   1. Provide for universal, regular and offset drive capacity, allowing drive chain to fall at front, rear or non-offset for all shade drive end brackets. Universal offset shall be adjustable for future change.
   2. Provide hardware capable for installation of a removable fascia, for both regular and/or reverse roll, which shall be installed without exposed fastening devices of any kind.
   3. Provide shade hardware system that allows for removable regular and/or reverse roll fascias to be mounted continuously across two or more shade bands without requiring exposed fasteners of any kind.
   4. Provide shade hardware system that allows for operation of multiple shade bands (multi-banded shades) by a single chain operator, subject to manufacturer's design criteria. Connectors shall be offset to assure alignment from the first to the last shade band.
   5. Provide shade hardware system that allows multi-banded manually operated shades to be capable of smooth operation when the axis is offset a maximum of 6 degrees on each side of the plane perpendicular to the radial line of the curve, for a 12 degrees total offset.
   6. Provide positive mechanical engagement of drive mechanism to shade roller tube. Friction fit connectors for drive mechanism connection to shade roller tube are not

acceptable

7. Provide shade hardware constructed of minimum 1/8 inch (3 mm) thick plated steel or heavier as required to support 150 percent of the full weight of each shade.
8. Drive Bracket / Brake Assembly:
    a. Mecho Drive Bracket model Mecho5x shall be fully integrated with all Mecho accessories, including, but not limited to: SnapLoc fascia, SnapLoc Zipper channels, room darkening side / sill channels, center supports and connectors for multi-banded shades.
    b. Mecho5x drive sprocket and brake assembly shall rotate and be supported on a welded 3/8 inch (9.5 mm) steel pin.
    c. The brake shall be an over-running clutch design which disengages to 90 percent during the raising and lowering of a shade. The brake shall withstand a pull force of 50 lbs. (22 kg) in the stopped position.
    d. The braking mechanism shall be applied to an oil-impregnated hub on to which the brake system is mounted. The oil impregnated hub design includes an articulated brake assembly, which assures a smooth, non-jerky operation in raising and lowering the shades. The assembly shall be permanently lubricated. Products that require externally applied lubrication and or not permanently lubricated are not acceptable.
    e. The entire Mecho5x assembly shall be fully mounted on the steel support bracket, and fully independent of the shade tube assembly, which may be removed and reinstalled without effecting the roller shade limit adjustments.
    f. Drive Chain: No. 10 qualified stainless steel chain rated to 90 lbs (41 kg) minimum breaking strength. Nickel plate chain shall not be accepted.

2.6 SHADE MOTOR DRIVE SYSTEM

A. Shade Motors:
    1. Tubular, asynchronous (non-synchronous) motors, with built-in reversible capacitor operating at 110 VAC (60 hz), single phase, temperature Class A, thermally protected, totally enclosed, maintenance free with line voltage power supply equipped with locking disconnect plug assembly furnished with each motor.
    2. Conceal motors inside shade roller tube.
    3. Maximum current draw for each shade motor of 2.3 amps.
    4. Use motors rated at the same nominal speed for all shades in the same room.

B. Total hanging weight of shade band shall not exceed 80 percent of the rated lifting capacity of the shade motor and tube assembly.

2.7 MOTOR CONTROL SYSTEMS

A. Quiet Intelligent Encoded Motor System (software, two-way communication): Specifications and design are based on the Intelligent Motor Control System / WhisperShade-IQ Motor System) as manufactured by Mecho. Other systems may be acceptable providing all of the following performance capabilities are provided. Motor control systems not in complete compliance with these performance criteria shall not be accepted as equal systems.
    1. Quiet operation of up to 46 dBa within 3 feet (914 mm), open air.
    2. Upper and lower stopping points (operating limits) of shade bands shall be programmed into motors via a hand held removable program module / configurator.
    3. Intermediate stopping positions for shades shall allow for up to three repeatable and precise aligned positions.
    4. Up to 103 available alignment points including 3 user programmable predefined intermediate positions, for a total of 5 defined and aligned positions. All shades on the same switch circuit with the same opening height shall align at each intermediate stopping position.
    5. Two inherent methods of control:
        a. Cost effective, low voltage, hardwired dry-contact for local switch or 3rd party

control operation.
b. Expandable to 2 way communication network with IQ/485-NI to support whole building low-voltage control and integration.

6. Mecho-RF via Zigby and EnOcean wireless mesh, network communication available to reduce low voltage wiring and field labor associated costs.
7. Uniform or Regular Modes of Operation:
   a. Uniform mode shall allow for shades to only move to intermediate stop positions.
   b. Regular mode shall allow for shades to move to both intermediate stop positions, plus any position desired between the upper and lower limits as set by the installer.
8. Wall Switches:
   a. IQ-Switch: in 5 or 10 button, single gang, low voltage.
9. Provide Wall Switches:
   a. Shades shall be operated by a 4 and 8 button low voltage standard switches or programmable intelligent switches (IS). Standard switch shall be wired to a bus interface and the bus interface will be programmed to transmit an address for the local switch.
   b. Intelligent switches may be installed anywhere on the busline. Each IS shall be capable of storing one control level address to be broadcast along the busline.
   c. An address that is transmitted by either a switch or central controller shall be responded to by those motors with the same address in their control table.
   d. IS shall provide for interface with other low voltage input devices via a set of dry contact terminals located on the switch.
   e. Standard switch or IS may control an individual, sub-group or group of motors in accordance with the address in each motor.

B. IQ/MLC: Specifications and design of shade motors and motor control system are based on the IQ/MLC motor logic control system manufactured by Mecho. Other systems may be acceptable provide that all of the following performance capabilities are provided. Motor logic control systems not in complete compliance with these performance criteria shall not be accepted as equal systems.
   1. Motor Control System:
      a. Provide power to each shade motor via individual 3 conductor line voltage circuits connecting each motor to the relay based motor logic controllers (IQ/MLC).
      b. Control system components shall provide appropriate (spike and brown out) over-current protection (plus or minus 10 percent of line voltage) for each of the four individual motor circuits and shall be rated by UL or ETL as a recognized component of this system and tested as an integrated system.
      c. Motor control system shall allow each group of four shade motors in any combination to be controlled by each of four local switch ports, with up to fourteen possible "sub-group" combinations via local 3 button wall switches and all at once via a master 3 button switch. System shall allow for overlapping switch combinations from two or more local switches.
      d. Multiple "sub-groups" from different IQ/MLC control components shall be capable of being combined to form "groups" operated by a single 3 button wall switch, from either the master port or in series from a local switch port.
      e. Each shade motor shall be accessible (for control purposes) from up to four local switches and one master switch.
      f. Control system shall allow for automatic alignment of shade hem bars in stopped position at 25 percent, 50 percent, and 75 percent of opening heights, and up to three user-defined intermediate stopping positions in addition to all up / all down, regardless of shade height, for a total of five positions. Control system shall allow shades to be stopped at any point in the opening height noting that shades may not be in alignment at these non-defined positions).

g. Control system shall have two standard operating modes: Normal mode allowing the shades to be stopped anywhere in the window's opening height and uniform mode, allowing the shades to only be stopped at the predefined intermediate stop positions. Both modes shall allow for all up / all down positioning.
h. Control system components shall allow for interface with both audiovisual system components and building fire and life safety system via a dry contact terminal block.
i. Control system components shall allow for interface with external analog input control devices such as solar activated controllers, 24 hour timers, and similar items; via a dry contact terminal block.
j. Reconfiguration of switch groups shall not require rewiring of the hardwired line voltage motor power supply wiring, or the low voltage control wiring. Reconfiguration of switch groups shall be accomplished within the motor control device (IQ/MLC).

2. Wall Switches:
a. Three-button architectural flush mounted switches with metal cover plate and no exposed fasteners.
b. Connect local wall switches to control system components via low voltage (12V DC) 4-conductor modular cable equipped with RJ-11 type connectors supplied, installed and certified under Division 16 - Electrical.
c. Connect master wall switches to control system components via low voltage (12V DC) 6-conductor modular cable equipped with RJ-12 type connectors supplied, installed and certified under Division 16 - Electrical.

2.8 ZIPPER SHADE SYSTEM

A. Zipper Shade System: ShadeLoc by Mecho, a zipper shade system that uses side channels to capture the zippered edges of the shadecloth.
1. Description: Zippers welded to the edges of shadecloth to lock it into the channels using SnapLoc assembly that conceals fasteners and plugs.
2. Configuration: Single-shade.
3. Configuration: Double-shade.
4. Assembly: Electro/SL Single with standard bracket.
5. Assembly: Electro/SL Double with standard bracket.
6. Assembly: Electro/SL Double Extended with standard bracket.
7. Assembly: Electro/1 with alternative bracket.
8. Assembly: Electro/2 with alternative bracket.
9. Assembly: Electro/2 Extended with alternative bracket.
10. Side Channels for Standard ElectronicDrive Units: 2 inches (51 mm).
11. Side Channels for IQ ElectronicDrive Units: 1-1/2 inches (38 mm).
12. Center Support Channels: 2-1/2 inches (63.5 mm).
13. Cover: Seamless.

2.9 ACCESSORIES

A. Roller Shade Pocket: ElectroPocket and Non-ElectroPocket from Mecho. For recessed mounting in acoustical tile, or drywall ceilings as indicated on the Drawings. For manual and motorized shades.
1. Provide either extruded aluminum and or formed steel shade pocket with extruded aluminum trim for all exposed components, sized to accommodate roller shades, with exposed extruded aluminum closure, tile support and removable closure panel to provide access to shades. The max roll diameter shall provide a minimum of clearance of 1/4 inch (6 mm) from the top and 2 sides of the pocket and 1/2 inch (13 mm) clear from the inside of the accessible pocket closure.
a. Provide "Vented Pocket" such that there will be a minimum 12 sq inch (7742 sq

mm) of return air per lineal foot allowing the solar gain to flow above the ceiling line into the plenum or over the roller shades into the interior space.

2. Provide ETL/UL 235 Approved extruded aluminum KD ElectroPocket, in 10 ft. (3048 mm) lengths assembled on job site, with an integrated wiring raceway and mounting clips for:
   a. Line Voltage disconnect connectors.
   b. Wireless receivers.
   c. Low Voltage splitters.
   d. Daisy chain non-plenum wiring raceway and integrated pocket assembly.
3. Model: ElectroPocket 4155 with tile support.
   a. Dimensions: (W x H): 5-3/4 x 6-1/4 inch (146 x 159 mm).
   b. Maximum Roll Up Diameter: 4-1/4 inch (108 mm).
4. Model: ElectroPocket Model 4156 without tile support.
   a. Dimensions: (W x H): 5-3/4 x 6-1/4 inch (146 x 159 mm).
   b. Maximum Roll Up Diameter: 4-1/4 inch (108 mm).
5. Model: ElectroPocket Model 4165 with tile support.
   a. Dimensions (W x H): 6-5/8 x 6-1/4 inch (168 x 159 mm).
   b. Maximum Roll Up Diameter: 4-5/8 inch (117.5 mm)
6. Model: ElectroPocket Model 4166 without tile support.
   a. Dimensions (W x H): 6-5/8 x 6-1/4 inch (168 x 159 mm).
   b. Maximum Roll Up Diameter: 4-5/8 inch (117.5 mm).
7. Model: Non-ElectroPocket 4157 with tile support.
   a. Dimensions: (W x H): 5-3/4 x 6-1/4 inch (146 x 159 mm).
   b. Maximum Roll Up Diameter: 4-5/8 inch (117.5 mm).
8. Model: Non-ElectroPocket without tile support.
   a. Dimensions (W x H): 5-3/4 x 6-1/4 inch (146 x 159 mm).
   b. Maximum Roll Up Diameter: 4-5/8 inch (117.5 mm).
9. Model: Non-ElectroPocket with tile support.
   a. Dimensions (W x H): 6-5/8 x 6-1/4 inch (168 x 159 mm).
   b. Maximum Roll Up Diameter: 5-1/8 inch (130 mm).
10. Model: Non-ElectroPocket 4168 without tile support.
    a. Dimensions (W x H): 6-5/8 x 6-1/4 inch (168 x 159 mm).
    b. Maximum Roll Up Diameter: 5-1/8 inch (130 mm).

B. Pocket Accessories: As indicated on the Drawings.

C. Fascia:
1. Continuous removable extruded aluminum fascia that attaches to shade mounting brackets without the use of adhesives, magnetic strips, or exposed fasteners.
2. Fascia shall be able to be installed across two or more shade bands in one piece.
3. Fascia shall fully conceal brackets, shade roller and fabric on the tube.
4. Provide bracket / fascia end caps where mounting conditions expose outside of roller shade brackets.
5. Notching of Fascia for manual chain shall not be acceptable.

D. Room Darkening Channels:
1. Side Channels, Mecho: Extruded aluminum with polybond edge seals and SnapLoc-mounting brackets and with concealed fastening. Exposed fastening is not acceptable. Units 1-15/16 inches (49 mm) wide by 1-3/16 inches (30 mm) deep, two-band center channels, 2-5/8 inches (67 mm) wide by 1-3/16 inches (30 mm) deep. The 2-5/8-inch (67 mm) double-center channels may be installed at center-support positions of multi-band-shade ElectroShades. Mecho side channels 2-5/8 inch (67 mm) may be used as center supports for ElectroShades; shadebands up to 8 high. For shadebands over 8 feet (2438 mm), provide ElectroShade side channels.
   a. Blackout Lightseal Hembar: Channels shall accept one-piece exposed blackout hembar with vinyl seal to assure light control.

2. Side Channels, ElectroShade: Extruded aluminum with polybond edge seals and SnapLoc-mounting brackets and with concealed fastening. Exposed fastening is not acceptable. Units 2-1/2 inches (63.5 mm) wide by 1-3/16 inches (30 mm) deep; two-band center channels 5 inches (127 mm) wide by 1-3/16 inches (30.1 mm) deep. The 2-5/8-inch (67 mm) double-center channels may be installed at center-support positions of multi-band-shade ElectroShades. Mecho side channels 2-5/8 inches (67 mm) may be used as center supports for ElectroShades. Also provide for use with manually operated room darkening Mecho shades over 8 feet (2438 mm) in height.
   a. Blackout Lightseal Hembar: Channels shall accept one-piece exposed blackout hembar with vinyl seal to assure light control.
3. Sill Channels: Extruded aluminum with polybond edge seals and SnapLoc-mounting brackets and with concealed fastening. Exposed fastening is not acceptable.
4. Channel Color: Selected from manufacturer's standard colors.
5. Channel Color: Custom color.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install roller shades level, plumb, square, and true according to manufacturer's written instructions, and located so shade band is not closer than 2 inches (51 mm) to interior face of glass. Allow proper clearances for window operation hardware.

B. Turn-Key Single-Source Responsibility for Motorized Interior Roller Shades: To control the responsibility for performance of motorized roller shade systems, assign the design, engineering, and installation of motorized roller shade systems, motors, controls, and low voltage electrical control wiring specified in this Section to a single manufacturer and their authorized installer/dealer. The Architect will not produce a set of electrical drawings for the installation of control wiring for the motors, or motor controllers of the motorized roller shades. Power wiring (line voltage), shall be provided by the roller shade installer/dealer, in accordance with the requirements provided by the manufacturer. Coordinate the following with the roller shade installer/dealer:
   1. General Contractor shall provide power panels and circuits of sufficient size to accommodate roller shade manufacturer's requirements, as indicated on the mechanical and electrical drawings.
   2. General Contractor shall coordinate with requirements of roller shade installer/dealer, before inaccessible areas are constructed.
   3. General Contractor shall run line voltage as dedicated home runs (of sufficient quantity, in sufficient capacity as required) terminating in junction boxes in locations designated by roller shade dealer.
   4. General Contractor shall provide and run all line voltage (from the terminating points) to the motor controllers, wire all roller shade motors to the motor controllers, and provide and run low voltage control wiring from motor controllers to switch/ control

locations designated by the Architect. All above-ceiling and concealed wiring shall be plenum-rated, or installed in conduit, as required by the electrical code having jurisdiction.

5. General Contractor shall provide conduit with pull wire in all areas, which might not be accessible to roller shade contractor due to building design, equipment location or schedule.

C. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

D. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

E. Engage Installer to train Owner's maintenance personnel to adjust, operate and maintain roller shade systems.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Plastic-laminate-faced wood cabinets for music equipment storage.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittal procedures, project meetings, progress schedules and documentation, reports, coordination.

B. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance (O&M) data, warranties and bonds.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Submit manufacturer's specifications, installation instructions, and general recommendations Include data substantiating materials comply with requirements.

B. Shop Drawings: Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures.

C. See Section 01 3000 - Administrative Requirements, for submittal procedures.

D. Samples for Selection:

1. For cabinet finishes.

E. LEED Submittals: Refer to Division 1 Section “Sustainable Design Requirements.”

1.04 QUALITY ASSURANCE

A. Design Requirements:

1. Provide storage cabinets specifically designed for intended use and meeting minimum performance characteristics specified. Music instrument storage units will be chip and abrasion resistant under heavy usage and will protect instruments and cases from damage under normal use.

2. Provide one-piece high molecular polyethylene instrument shelving with integral ventilation grooves, designed and engineered to withstand continuous use without surface or front edge breakdown. Two part plastic overlay shelf systems will not be allowed.

3. Manufacture individual instrument storage cabinets with thermofused polyester laminated panels, finish both faces all components. Factory jig and drill end panels to accept unit- to-unit through-bolting: wood screw attachment not permitted. Furnish each instrument storage cabinet with an integral base and four (4) steel levelers accessible from within the unit but concealed in final installation. These features combine to provide modularity, on-site rearrangement or future relocation of any music education storage cabinet.

4. Provide inset style solid panel doors, wire grille as shown on drawings, reveal or full overlay style solid or wire grille doors will not be permitted due to inherent weakness of overlay hinges. All hinges shall be structurally attached to vertical panels using engineered and tested through-bolt hardware, and welded to wire grille doors, screw mounted hinges will not be permitted.

B. Manufacturer to provide documentation of following Minimum Performance Requirements:

1. Molded plastic instrument storage shelves shall have static load capacity over 1000 lbs.

2. Full height door to support a minimum vertical dynamic live load of 315 lb., applied at outer edge (door must swing 1800, back and forth, with full weight).

3. Wire grille door welded to door hinge in five places, pull tested to withstand 3,000 lbs.
4. Instrument storage shelf system shall have a factory warranty of ten (10) years against defects in material and/or workmanship.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver music equipment storage casework only after painting, utility roughing-in, and similar operations that could damage, soil, or deteriorate casework have been completed in installation areas. If casework must be stored in other than installation areas, store only in areas where environmental conditions meet requirements specified in “Project Conditions” Article.

B. Keep finished surfaces covered with protective covering during handling and installation.

1.06 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and will maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

1.07 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of music equipment storage casework that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:

1. Delamination of components or other failures of glue bond.

B. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

1. Warping of components.
2. Failure of operating hardware.
3. Deterioration of finishes.

C. Warranty Period:

1. Cabinet Casework: Ten years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: The design for music equipment storage casework is based on Wenger Corp. (www.wengercorp.com) Subject to compliance with requirements, provide the named product or a comparable prequalified product. Manufacturer requesting prior approval must submit samples of materials, construction features and finishes.

1. Sample cabinet.
2. Typical shelf.
3. Cabinet wall.
4. Door panel.
5. Hinges.
6. Slide bolts. (padlock hasps not acceptable)

B. SUBSTITUTIONS

1. The materials and products of the manufacturer listed above are approved as base bid for this project. All bids shall be submitted on the base bid products and materials. Proposed “write in” or voluntary alternates will not be considered in determining the low bid or the award of the contract.

2. The burden of demonstrating the merit of the proposed substitute is on the proposer. The proposer shall be prepared to supply the specified material or products from the specified supplier if the proposed substitute is not accepted.
3. The materials, products and equipment in the bidding documents establish the required standard of function, dimension, appearance and quality to be met by any proposed substitute.

C. Subject to conformance with specifications, including features not standard to the manufacturer, the following manufacturers may provide products for this project subject to submittal and approval by Owner and Architect of samples of materials, construction features and finishes stipulated in Paragraph 2.1A.

1. Corilam
2. TMI
3. Casework USA.

2.02 STORAGE CASEWORK

A. General: Provide the following music equipment storage plastic laminate clad casework units with solid doors manufactured to AWI specifications for Section 400B, “Custom” grade. Cabinet backs shall be side bound, captured in grooves on cabinet sides, glued and pinned. Provide thermofused polyester facing on minimum 45 lb. particleboard at all panels. Provide minimum 3 mm PVC edges to particleboard elements.

1. Provide casework items equal to models referenced by Wenger catalogue numbers.
2. Composite wood and agrifiber products permanently installed inside the weather- proofing system shall contain no added urea formaldehyde resins or laminating adhesives. Materials considered fixtures, furniture, and equipment are not considered base building elements and are thus excluded from this restriction.

B. Thermofused Polyester Panels: Particleboard finished with thermally fused polyester complying with ALA 1992.

1. Particleboard: ANSI A208.1, Grade M-2.
2. Provide 3.0 mm PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semi-exposed edges.

C. Instrument Shelves: Provide shelf units that are repairable or replaceable without dismantling case construction. Provide ten year written warranty on shelf units to repair or replace gouged or deteriorated shelf units damaged under normal heavy-use conditions.

1. Cabinets up to 27 inches wide: One-piece blow-molded polyethylene with 1-3/8 inch radius front edge. Mount to cabinet walls with one-piece molded rigid ST nylon clip. Shelf is replaceable without damage to adjacent surfaces. Doweled shelves will not be permitted. Shelf shall not have tight fit to cabinet wall in order to allow air flow through all compartments.
2. Cabinets over 27 inches wide: One-piece formed polyethylene with radius front edge and 3/16" wall thickness. Ribbed for structural integrity. Supported by four structural tubular members 1-1/2" x 1" x 16 gauge wall thickness with 14 gauge welded end plates.

D. Doors: Provide the following:

1. Grille Doors: Wire grille doors of minimum 3/16" diameter steel rod welded; enamel finish; with name/number plate and padlock hasp. Welded steel grille construction with powder coat finish, color oyster. Welds at T-joints must be 3600
    a. Hinges, 5-knuckle institutional type hinge. Hinge will support 315 lbs. dynamic vertical load. Hinge pin shall be 2 3/4 inches long. Hinge welded to door frame in five places, fastened to

cabinet with through-bolt construction using steel threaded inserts. Inserts have angled teeth that bite into the wood as the bolt is tightened; attachment by wood screws not acceptable.

2. Locking slide-bolt. All doors shall be factory provided with locking slide- bolt designed for padlocks, with formed steel strike plate through-bolt connected to cabinet end panel, 12 gauge steel. Padlocks shall be positioned toward the center of the latch, away from the edge in order to all access to locks when adjacent doors are opened. Provide clear plastic label holder for identification card insert. Finish: Powder paint coating, color oyster.

E. Finish Hardware:

1. Joinery Hardware: two inch, 1/4-20 panel connectors with 15mm head diameter, and steel thread inserts. Finish: Powder paint coating, color - oyster. Dowel and glue construction is not allowed.

2. Cabinet levelers: Structural levelers each cabinet, accessible from within the unit when desired, concealed in complete installation. Four leveling glides within minimum 3/8- inch diameter threaded rod in steel corner brackets, six glides for cabinets with divider panels. Cabinets shall not sit on a base, but shall be complete within themselves. Leveling with shims is not allowed.

F. Cabinet Back Panel: Standard cabinet back to be 1/4" thick prefinished hardboard, color oyster to match interior of side and top panels.

2.03 MUSIC STORAGE CASEWORK SCHEDULE

A. Provide casework items equal to models referenced by Wenger catalogue numbers.

B. Refer to “Equipment Schedule – Music Room” on Sheet A7.1.7.

C. All units are 84" height by dimensions indicated, unless noted otherwise. Provide lockable door for cabinet or each compartment of cabinets for all locations.

PART 3 EXECUTION

3.01 CASEWORK INSTALLATION

A. Install casework plumb, level, and true in accordance with manufacturer's printed instructions and recommendations

B. Adjust casework and hardware so doors operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

3.02 CLEANING AND PROTECTING

A. Repair or remove and replace defective work as directed on completion of installation.

B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

C. Protection: Provide 6-mil plastic or other suitable water-resistant covering over case tops. Tape covering in place at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

3.03 INSTALLATION

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Wood laboratory casework.
2. Laboratory countertops.
3. Shelves.
4. Laboratory sinks and troughs.
5. Laboratory fixtures.
6. Accessories.

B. Wood laboratory casework and equipment as specified herein and as scheduled, and noted on the drawings is to be furnished, delivered, and installed in the location required by the drawings, and left ready for connection of plumbing fixtures and electrical fixtures by others.

C. Casework, equipment, service fixtures and related work shall include:

1. Furnishing, delivering to the building, uncrating, setting in place and leveling all casework and equipment listed in this specification or equipment schedule and/or shown on the drawings.
2. Furnishing plumbing fixtures and fittings as defined in this specification, complete with tank nipples and lock nuts for mounting fixtures and fittings to tops or curbs. Fixtures shall be furnished assembled, in properly marked cartons for installation by casework contractor. Final hook up or connection to services shall be by others. Nipples for hot and cold water shall be brass.
3. Furnishing electrical service fixtures directly attached to the casework or equipment as called for in this specification, equipment list and/or shown on the drawings. Fixtures shall be furnished assembled in properly marked cartons for installation and final hook up or connection by others. Rough in boxes for duplex receptacles and data drops located in cabinetry or aprons shall be installed at the factory by the equipment manufacturer.
4. Furnishing of sink bowls and cupsinks, complete with required sink supports, overflows, and outlets with plugs and strainers, as called for in this specification, equipment schedule and/or shown on the drawings. Units shall be assembled and installed by casework contractor. Separate outlets shall not exceed 4” in length. Outlets shall be furnished without couplings required to connect to the drain piping system. Installation of the outlets shall be by casework supplier.
5. Furnish along with specified fume hoods all service fixtures, fittings, remote control rods, escutcheon plates, valve handles and nipples. Service fixtures shall be furnished attached to superstructure and pre-piped below countertop for final connection by others.
6. Furnishing and installing countertops as shown on the drawings, of the size and shape required on all laboratory casework.
7. Remove all debris, dirt and rubbish accumulated as a result of installation of this equipment, leaving premises broom clean and orderly.
8. Final Adjustment: It is recognized that wood doors and drawers will swell and stick because of unusually high ambient moisture in new construction work. Casework installer shall during the first year return after final inspection to make any final adjustments to drawers and doors to eliminate sticking or other problems. Any doors or drawers, which cannot be corrected shall be replaced.

D. Related Sections include the following:

1. Division 6 Section "Rough Carpentry" for wood blocking for anchoring laboratory casework.
2. Division 9 Section "Gypsum Board Assemblies" for reinforcements in metal-framed gypsum board partitions for anchoring laboratory casework.
3. Division 9 Section "Resilient Flooring" for resilient base applied to wood laboratory casework.
4. Division 11 Section "Laboratory Fume Hoods" for fume hoods, including base cabinets and countertops under fume hoods.
5. Division 23 Sections for sinks and fittings in countertops.

E. Division 26 Sections for electrical fittings and outlets.

1.02 DEFINITIONS

A. Exposed Portions of Casework: Surfaces visible when doors and drawers are closed, including bottoms of cabinets more than 48 inches above floor, and visible surfaces in open cabinets or behind glass doors.

1. Ends of cabinets indicated to be installed directly against and completely concealed by walls or other cabinets after installation shall not be considered exposed.

B. Semiexposed Portions of Casework: Surfaces behind opaque doors, such as interiors of cabinets, shelves, dividers, interiors and sides of drawers, and interior faces of doors. Tops of cases 78 inches or more above floor are defined as semiexposed.

C. Concealed portions of casework include sleepers, web frames, dust panels, and other surfaces not usually visible after installation.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include independent certification that applied finish complies with specified chemical and physical resistance requirements.

B. Shop Drawings: For wood laboratory casework. Include plans, elevations, sections, details, and attachments to other work.

1. Indicate locations of blocking and reinforcements required for installing laboratory casework.
2. Include details of exposed conduits, if required, for service fittings.
3. Indicate locations of and clearances from adjacent walls, doors, windows, other building components, and other laboratory equipment.
4. Include coordinated dimensions for laboratory equipment and service fittings specified in other Sections.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating compliance of laboratory casework finishes and countertops with requirements specified for chemical and physical resistance.

D. Maintenance Data: For laboratory casework to include in maintenance manuals.

E. Warranty: Special warranty specified in this Section.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain laboratory casework, including countertops, sinks, service fittings, and accessories, through one source from a single manufacturer.

1. Obtain through same source from same manufacturer as fume hoods specified in Division 11 Section "Laboratory Fume Hoods."

B. Product Designations: Drawings indicate sizes and configurations of laboratory casework by referencing designated manufacturer's catalog numbers. Unless modified by notation on Drawings, or otherwise specified, catalog description for designated product constitutes requirements for each product and establishes a standard of design and quality for materials, construction and workmanship. Other acceptable manufacturers' laboratory casework of similar sizes, similar door and drawer configurations, and complying with the Specifications will be accepted.

C. Product Standard: Comply with SEFA 8, "Laboratory Furniture--Casework, Shelving and Tables--Recommended Practices."

D. Flammable Liquid Storage: Where cabinets are indicated for solvent or flammable liquid storage, provide units that are listed and labeled as complying with requirements of NFPA 30 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

F. Accessibility Requirements: In addition to local governing regulations, comply with “Americans with Disabilities Act (ADA), Accessibility Guidelines (ADAAG).”

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Administrative Requirements."

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver laboratory casework only after wet operations in areas where casework is to be installed are completed.

B. Protect finished surfaces during handling and installation with protective covering of polyethylene film or other suitable material.

C. Store completed laboratory casework in a ventilated place, protected from the weather, with relative humidity of 50 percent or less at 70 deg F.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install wood laboratory casework until building is enclosed, wet work and utility roughing-in are complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.07 COORDINATION

A. Coordinate layout and installation of framing and reinforcements for support of wood laboratory casework.

B. Coordinate installation of wood laboratory casework with installation of fume hoods and other laboratory equipment.

1.08 WARRANTY

A. Special Warranty: Submit a written warranty executed by the manufacturer agreeing to repair or replace components of laboratory casework systems due to defects of material and workmanship. Warranty shall not cover damage caused by misuse or negligence.

1. Warranty Period: 3years from date of Substantial Completion.

1.09 EXTRA MATERIALS

A. Furnish complete touchup kit for each type and color of wood laboratory casework provided. Include scratch fillers, stains, finishes, and other materials necessary to perform permanent repairs to damaged laboratory casework finish.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Wood Laboratory Casework:
    a. Campbell Rhea.
    b. Leonard Peterson.
    c. Sheldon Laboratory Systems.
    d. Kewaunee Scientific Corporation, Laboratory Products Group.
2. Epoxy Countertops, Sinks and Troughs:
    a. Durcon Company, Inc. (The).
    b. Epoxyn Products.
    c. Laboratory Tops, Inc.
    d. Prime Industries, Inc.

2.02 CABINET MATERIALS

A. General:

1. Maximum Moisture Content for Lumber: 7 percent for hardwood and 12 percent for softwood.
2. Hardwood Plywood: HPVA HP-1 made with adhesive containing no urea formaldehyde, either veneer core or particle core, unless otherwise indicated.
3. Edgebanding for Wood-Veneered Construction: Minimum 1/8-inch-thick, solid wood of same species as face veneer; laminating glue shall contain no urea-formaldehyde.

B. Exposed Materials:

1. General: Provide materials that are selected and arranged for compatible grain and color. Do not use materials adjacent to one another that are noticeably dissimilar in color, grain, figure, or natural character markings.
2. Wood Species and Veneer Cut: Maple, plain sawn.
3. Stain Colors and Finishes: As selected by Architect from manufacturer's full range.
4. Solid Wood: Clear hardwood lumber.
5. Plywood: Urea-formaldehyde free hardwood plywood; Grade A exposed faces at least 1/50 inch thick, Grade J crossbands, and backs of same species as faces.

C. Semiexposed Materials:

1. Solid Wood: Sound hardwood lumber, selected to eliminate appearance defects, of any species similar in color and grain to exposed solid wood.

2. Plywood: Urea-formaldehyde free hardwood plywood of any species similar in color and grain to exposed plywood. Grade B faces, Grade J crossbands, and backs of same species as faces. Semiexposed backs of plywood with exposed faces shall be same species as faces.

D. Concealed Materials:

1. Solid Wood: Any hardwood or softwood species, with no defects affecting strength or utility.
2. Plywood: Urea-formaldehyde free hardwood plywood. Concealed backs of plywood with exposed or semiexposed faces shall be same species as faces.
3. Particleboard: ANSI A208.1, Grade M-3 Exterior Glue complying with requirements in ANSI A208.1, Grade M-3.
4. Hardboard: AHA A135.4, Class 1 tempered.

E. Glass for Glazed Doors: Clear tempered glass complying with ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality q3; not less than 5.5 mm thick.

2.03 CABINET DESIGN

A. As indicated by scheduled product listed on the Drawings.

B. Grain Direction: Vertical on doors, horizontal on drawer fronts.

2.04 CABINET FABRICATION

A. Construction: Provide wood-faced laboratory casework of the following minimum construction:

1. Bottoms and Ends of Cabinets, Shelves, and Tops of Wall Cabinets and Tall Cabinets: 3/4-inch-thick plywood.
2. Base Cabinet Top Frames: 3/4-by-2-inch solid wood with mortise and tenon or doweled connections, glued with urea-formaldehyde free glue and pinned or screwed.
3. Backs of Cabinets: 3/4-inch- thick plywood where exposed, 1/4-inch- thick hardboard dadoed into sides, bottoms, and tops where not exposed.
4. Security Panels: 1/4-inch-thick hardboard panels between drawers and between drawers and doors when base cabinet locks are keyed differently.
5. Drawer Fronts: 3/4-inch- thick plywood or solid hardwood.
6. Drawer Sides and Backs: 1/2-inch- thick solid wood or plywood, with urea-formaldehyde free glued dovetail or multiple-dowel joints.
7. Drawer Bottoms: 1/4-inch- thick plywood glued and dadoed into front, back, and sides of drawers. Use 1/2-inch- thick material for drawers more than 24 inches wide.
8. Doors 48 Inches or Less in Height: 3/4 inch thick, with particleboard or medium-density fiberboard cores, solid hardwood stiles and rails, and hardwood face veneers and crossbands.
9. Doors More Than 48 Inches in Height: 1-1/8 inches thick, with honeycomb cores, solid hardwood stiles and rails, and veneer plywood on both sides.
10. Stiles and Rails of Glazed Doors: 3/4-inch- thick solid hardwood.

B. Leg Shoes: Vinyl or rubber, black, open-bottom type.

1. Provide minimum 1-1/2-inch-diameter, nonmarring floor glides with minimum 5/8-inch height adjustment capability, for open-leg tables.

C. Filler Strips: Provide as needed to close spaces between cabinets and walls, ceilings, and indicated equipment. Fabricate from same material and with same finish as cabinet fronts.

D. Accessibility Requirements: Modify cabinets where indicated, as required to comply with the “Americans with Disabilities Act (ADA).”

2.05 WOOD FINISH

A. Preparation: Sand lumber and plywood for laboratory casework construction before assembling. Sand edges of doors, drawer fronts, and molded shapes with profile-edge sander. Sand casework after assembling for uniform smoothness at least equivalent to that produced by 220 grit sanding and without machine marks, cross sanding, or other surface blemishes.

B. Staining: Remove fibers and dust and apply stain to exposed and semiexposed surfaces as necessary to match approved Samples. Apply stain in a manner that will produce a consistent appearance. Apply wash-coat sealer before applying stain to closed-grain wood species.

C. Chemical-Resistant Finish: Apply laboratory casework manufacturer's standard three-coat, chemical-resistant, transparent finish consisting of sealer and catalyzed topcoat(s). Sand and wipe clean between coats. Topcoat(s) may be omitted on concealed surfaces.

1. Chemical and Physical Resistance of Finish System: Finish complies with acceptance levels of cabinet surface finish tests in SEFA 8. Acceptance level for chemical spot test shall be no more than four Level 3 conditions.

2.06 CABINET HARDWARE

A. General: Provide laboratory casework manufacturer's standard satin-finish, commercial-quality, heavy-duty hardware complying with requirements indicated for each type.

B. Hinges: Stainless-steel, 5-knuckle hinges complying with BHMA A156.9, Grade 1, with antifriction bearings and rounded tips. Provide 2 for doors 48 inches or less in height; 3 for doors more than 48 inches in height.

C. Pulls: Solid aluminum, stainless steel, or chrome-plated brass; fastened from back with two screws. For sliding doors, provide stainless-steel or chrome-plated recessed flush pulls. Provide 2 pulls for drawers more than 24 inches in width.

D. Door Catches: Nylon-roller spring catch or dual, self-aligning, permanent magnet catch. Provide 2 catches on doors more than 48 inches in height.

E. Drawer Slides: Powder-coated, full-extension, self-closing, heavy-duty drawer slides; designed to prevent rebound when drawers are closed; with nylon-tired, ball-bearing rollers; and complying with BHMA A156.9, Type B05091, and rated for 100 lbf.

F. Label Holders: Stainless steel, aluminum, or chrome plated; sized to receive standard label cards approximately 1 by 2 inches, attached with screws or rivets. Provide on all drawers.

G. Locks: Cam type with 5-pin tumbler, brass with chrome-plated finish; complying with BHMA A156.11, Type E07281.

1. Provide minimum of two keys per lock and two master keys.

2. Provide on all drawers and doors.

H. Adjustable Shelf Supports: Pin-type, corrosion-resistant coated shelf support clips for mounting on interior of cabinet work, to retain shelves from accidental removal. Shelves shall be adjustable on 2-inch centers. Surface mounted metal support strips and clips subject to corrosion are not acceptable.

2.07 COUNTERTOPS, TROUGHS, AND SINKS

A. Countertops, General: Provide units with smooth surfaces in uniform plane free of defects. Make exposed edges and corners straight and uniformly beveled. Provide front and end overhang of 1 inch, with continuous drip groove on underside 1/2 inch from edge.

B. Sinks, General: Provide sizes indicated or laboratory casework manufacturer's closest standard size of equal or greater volume, as approved by Architect.

1. Outlets: Provide with strainers and tailpieces, NPS 1-1/2, unless otherwise indicated.

2. Overflows: For each sink except cup sinks, provide overflow of standard beehive or open-top design with separate strainer. Height 2 inches less than sink depth. Provide in same material as strainer.

C. Epoxy Countertops, Troughs, and Sinks: Factory molded of modified epoxy-resin formulation with smooth, nonspecular finish.

1. Physical Properties:

a. Flexural Strength: Not less than 10,000 psi.

b. Modulus of Elasticity: Not less than 2,000,000 psi.

c. Hardness (Rockwell M): Not less than 100.

d. Water Absorption (24 Hours): Not more than 0.02 percent.

e. Heat Distortion Point: Not less than 260 deg F.

2. Chemical Resistance: Epoxy-resin material has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:

a. No Effect: Acetic acid (98 percent), acetone, ammonium hydroxide (28 percent), benzene, carbon tetrachloride, dimethyl formamide, ethyl acetate, ethyl alcohol, ethyl ether, methyl alcohol, nitric acid (70 percent), phenol, sulfuric acid (60 percent), and toluene.

b. Slight Effect: Chromic acid (60 percent) and sodium hydroxide (50 percent).

3. Color: Black.

4. Countertop Fabrication: Fabricate with factory cutouts for sinks and with butt joints assembled with epoxy adhesive and prefitted, concealed metal splines.

a. Countertop Configuration: Flat, 1 inch thick, with rounded edge and corners, and with drip groove and integral coved backsplash.

b. Countertop Construction: Uniform throughout full thickness.

5. Table Top Configuration: Raised (marine) edge, 1-1/4 inch thick at raised edge, with rounded edge and corners, and with integral coved backsplash.

6. Sink Fabrication: Molded in 1 piece with smooth surfaces, coved corners, and bottom sloped to outlet; 1/2-inch minimum thickness.

a. Provide with polypropylene strainers and tailpieces.

D. Cup Sinks: Material and size as indicated.

1. Provide epoxy cup sinks with polypropylene strainers and integral tailpieces.

E. Troughs: Epoxy. Comply with requirements for materials and construction as specified for countertops and sinks. Pitch to drains not less than 1/8 inch/foot.

1. Outlets: Except where troughs empty into sinks, provide NPS 1-1/2 outlets with strainers and tailpieces.

2. Provide epoxy troughs with polypropylene strainers and tailpieces.

2.08 ACCESSORIES

A. Reagent Shelves: Provide as indicated, fabricated from same material as adjacent countertop, unless otherwise indicated.

B. Pegboards: Polypropylene, epoxy, or phenolic-composite pegboards with removable polypropylene pegs and stainless-steel drip troughs with drain outlet.

2.09 PLUMBING AND ELECTRICAL FIXTURES

A. Plumbing fixtures shall be furnished in laboratory grade chrome plated brass as manufactured by Water Saver Faucet Company, The Chicago Faucet Company, or T & S Brass Works.

1. Fixtures provided with brass tank nipples complete with locknuts and washers for attachment to countertops.

2. Water fixtures to be provided with adjustable volume control (Water Saver BNV200AC or equal) and with atmospheric inline vacuum breakers.

3. Fixtures supplied assembled (tank nipples loose).

B. Safety showers and eyewashes shall be provided in materials as standard with catalog number specified. Safety showers and eyewashes shall be furnished assembled for final installation or mounting by others.

C. Pedestal electric boxes, cast aluminum finished in black textured coating furnished with tank nipples and locknuts for attachment to countertops.

1. Electrical boxes mounted in table or cabinet aprons shall be steel.

2. Electric receptacles, switches, etc., shall be specification grade 20 amp and UL approved. Receptacles located within 6’0” of sinks to be G.F.I. type.

3. Cover plates for receptacles shall be stainless steel.

D. Mounting of electric boxes in table aprons or cabinet units shall be by Casework Manufacturer

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of reinforcements, and other conditions affecting performance of wood laboratory casework.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF CABINETS

A. Install level, plumb, and true; shim as required, using concealed shims. Where laboratory casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.

B. Base Cabinets: Adjust top rails and subtops within 1/16 inch of a single plane. Fasten cabinets to utility-space framing, partition framing, wood blocking, or reinforcements in partitions with fasteners spaced not more than 24 inches o.c. Fasten adjacent cabinets together with joints flush, tight, and uniform. Align similar adjoining doors and drawers to a tolerance of 1/16 inch.

1. Where base cabinets are installed away from walls, fasten to floor at toe space at not more than 24 inches o.c. and at sides of cabinets with not less than 2 fasteners per side.

C. Wall Cabinets: Adjust fronts and bottoms within 1/16 inch of a single plane. Fasten to hanging strips, masonry, partition framing, blocking, or reinforcements in partitions. Fasten each cabinet through back, near top, at not less than 24 inches o.c. Align similar adjoining doors to a tolerance of 1/16 inch.

D. Install hardware uniformly and precisely. Set hinges snug and flat in mortises.

E. Adjust laboratory casework and hardware so doors and drawers align and operate smoothly without warp or bind and contact points meet accurately. Lubricate operating hardware as recommended by manufacturer.

3.03 INSTALLATION OF COUNTERTOPS

A. Abut top and edge surfaces in one true plane with flush hairline joints and with internal supports placed to prevent deflection. Locate joints only where shown on Shop Drawings.

B. Field Jointing: Where possible, make in the same manner as shop jointing using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop.

1. Use concealed clamping devices for field joints in plastic-laminate countertops. Locate clamping devices within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a uniform heavy pressure at joints.

C. Fastening:

1. Secure epoxy countertops to cabinets with epoxy cement, applied at each corner and along perimeter edges at not more than 48 inches o.c.

2. Where necessary to penetrate countertops with fasteners, countersink heads approximately 1/8 inch and plug hole flush with material equal to countertop in chemical resistance, hardness, and appearance.

D. Provide required holes and cutouts for service fittings.

E. Seal unfinished edges and cutouts in plastic-laminate countertops with heavy coat of polyurethane varnish.

F. Provide scribe moldings for closures at junctures of countertop, curb, and splash, with walls as recommended by manufacturer for materials involved. Match materials and finish to adjacent laboratory casework. Use chemical-resistant, permanently elastic sealing compound where recommended by manufacturer.

G. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

3.04 INSTALLATION OF SINKS

A. Underside Installation of Epoxy Sinks: Use laboratory casework manufacturer's recommended adjustable support system for table- and cabinet-type installations. Set top edge of sink unit in sink and countertop manufacturers' recommended chemical-resistant sealing compound or adhesive and firmly secure to produce a tight and fully leakproof joint. Adjust sink and securely support to prevent movement. Remove excess sealant while still wet and finish joint for neat appearance.

3.05 INSTALLATION OF ACCESSORIES

A. Install accessories according to Shop Drawings and manufacturer's written instructions.

B. Securely fasten pegboards to partition framing, wood blocking, or reinforcements in partitions.

3.06 CLEANING AND PROTECTING

A. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

B. Protect countertop surfaces during construction with 6-mil plastic or other suitable water-resistant covering. Tape to underside of countertop at minimum of 48 inches o.c.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Countertops for architectural cabinetwork.

B. Wall-hung counters and vanity tops.

1.02 RELATED REQUIREMENTS

A. Section 06 41 00 - Architectural Wood Casework.

1.03 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

C. AWI/AWMAC (QSI) - Quality Standard Illustrated; Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada.

D. ISSFA-2 - Classification and Standards for Solid Surfacing Material; International Solid Surface Fabricators Association.

E. NEMA LD 3 - High-Pressure Decorative Laminates.

F. PS 1 - Structural Plywood.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Specimen warranty.

C. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other sections.

D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.

F. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

G. LEED Report: Submit for wood products made from sustainably harvested wood, salvaged and reused wood, wood fabricated from recovered timber, and locally-sourced wood, as specified in Section 01 35 15.

H. LEED Submittals: Provide documentation of VOC content in g/L for adhesives and sealants applied within the building waterproofing envelope; document no added urea formaldehyde for composite wood, agrifiber products and laminating adhesives.

I. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Same fabricator as for cabinets on which tops are to be installed.

B. Installer Qualifications: Fabricator.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 - PRODUCTS

2.01 COUNTERTOP ASSEMBLIES

A. Plastic Laminate Countertops: High pressure decorative laminate sheet bonded to substrate.

1. Laminate Sheet, Unless Otherwise Indicated: NEMA LD 3 Grade HGP, for postforming, 9 inch nominal thickness.
    a. Surface Burning Characteristics: Flame spread 25, maximum; smoke developed 450, maximum; when tested in accordance with ASTM E84.
    b. Wear Resistance: In addition to specified grade, comply with NEMA LD 3 High Wear Grade requirements for wear resistance.
    c. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
        1) As selected by Architect from laminate manufacturer's full range in solid colors, wood grains, and patterns, including stone, marble and leathers.
        2) Ten different colors may be selected by Architect for this Project.
    d. Manufacturers:
        1) Formica Corporation : www.formica.com.
        2) Lamin-Art, Inc : www.laminart.com.
        3) Panolam Industries International, IncNevamar : www.nevamar.com.
        4) Panolam Industries International, IncPionite : www.pionitelaminates.com.
        5) Wilsonart International, Inc : www.wilsonart.com.
2. Exposed Edge Treatment: Square, substrate built up to minimum 1-1/4 inch thick; covered with 3mm polyvinylchloride (PVC), machine applied with hot melt adhesive, inside/outside length radiused, corner radiused and buffed.
    a. Color selection for PVC edging will be made at a later date; Architect reserves the right to select colors manufactured and offered by Woodtape Edge Banding (at no additional cost to the Owner), when a standard selection offered by the casework manufacturer does not provide a suitable color in the Architect's opinion.
3. Back and End Splashes: Same material, same construction.
4. Fabricate in accordance with AWI/AWMAC Quality Standards Illustrated Premium Grade.

B. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.

1. Flat Sheet Thickness: 1/4 inch, minimum.

2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISSFA-2 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
    a. Surface Burning Characteristics: Flame spread 25, maximum; smoke developed 450, maximum; when tested in accordance with ASTM E84.
    b. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
    c. Color and Pattern: To be selected from manufacturer's full line.
    d. Manufacturers:
        1) Dupont : www.corian.com.
        2) Formica Corporation : www.formica.com.
        3) Avonite Surfaces : www.avonitesurfaces.com.
        4) Wilsonart International, Inc : www.wilsonart.com.
3. Other Components Thickness: 1/2 inch, minimum.
4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; square edge; use marine edge at sinks.
5. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
6. Skirts: As indicated on drawings.

C. Composite Wood and Laminating Adhesives: No added urea formaldehyde resins.

2.02 ACCESSORY MATERIALS

A. Wood-Based Components:
1. Wood fabricated from old growth timber is not permitted.
2. Composite Wood and Agrifiber Products: No added urea formaldehyde.

B. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.

C. Particleboard for Supporting Substrate: ANSI A208.1 Grade 2-M-2, 47 pcf minimum density; minimum 3/4 inch thick; join lengths using metal splines.

D. Backer Sheet: Provide substrate with laminate backer sheet.

E. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
1. Field□applied adhesives: Comply with low□emitting requirements in Section 01 61 16.

2.03 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
1. Join lengths of tops using best method recommended by manufacturer.
2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.

1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
2. Height: 4 inches, unless otherwise indicated.

C. Solid Surfacing: Fabricate tops up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

D. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings, finished to match.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.

C. Seal joint between back/end splashes and vertical surfaces.

3.03 CLEANING AND PROTECTION

A. Clean countertops surfaces thoroughly.

B. Protect installed products until completion of project.

C. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roll-up mats.

B. Recessed mat frames.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating properties of walk-off surface, component dimensions, recessed frame characteristics and profiles, and finishes.

C. Shop Drawings: Indicate dimensions, details for recessed frame, and divisions between mat sections.

1. For recessed frames located within a dimensionally restricted area, show dimensions of space within which the frame will be installed.

D. Samples for Initial Selection: For each type of product indicated.

E. LEED Submittals:

1. Credit MR 4: Product Data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.

a. Contributions to this Credit include recycled content of aluminum.

F. Maintenance Data: Include cleaning instructions and stain removal procedures.

1.03 QUALITY ASSURANCE

A. Source Limitations: Obtain floor mats and frames through one source from a single manufacturer.

B. Accessibility Requirements: Provide installed floor mats that comply with most stringent requirements of Section 4.5 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" and Sections 302 and 303 in ICC A117.1.

1.04 PROJECT CONDITIONS

A. Field Measurements: Indicate measurements on Shop Drawings.

1.05 COORDINATION

A. Coordinate size and location of recesses in concrete with installation of finish floors to receive floor mats and frames.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Floor Mats:

1. American Floor Products Company, Inc: www.afco-usa.com.

2. C. Musson Rubber Co: www.mussonrubber.com.

3. Pawling Corporation: www.pawling.com.

4. C/S Group .

2.02 MATS

A. Roll-Up, Aluminum-Rail Hinged Mats: Extruded-aluminum tread rails 1-1/2 inches wide by 3/8 inches thick, sitting on continuous vinyl cushions.

1. Tread Inserts: 32-oz./sq. yd. weight, fusion-bonded solution-dyed polypropylene carpet.
2. Rail Color: Clear.
3. Hinges: Aluminum.
4. Mat Size: As indicated.
5. Products:
    a. American Floor Products Company, Inc.; Stratoflex III Foot Grid System.
    b. C/S Group; Product Pedimat.
    c. Musson, R. C. Rubber Co.; Product EM-800.
    d. Pawling Corporation; Architectural Products Division; Product EM-800 Rol-Dek.

B. Recessed Frame:

1. Extruded Aluminum: ASTM B 221, Alloy 6061-T6 or Alloy 6063-T5, T6, or T52.
2. Color: Clear anodized.

2.03 CONCRETE FILL AND GROUT MATERIALS

A. Provide concrete grout and fill equivalent in strength to cast-in-place concrete slabs for recessed mats and frames. Use aggregate no larger than one-third fill thickness.

2.04 FABRICATION

A. Construct recessed mat frames square, tight joints at corners, rigid. Coat surfaces with protective coating where in contact with cementitious materials.

B. Fabricate mats in single unit sizes; fabricate multiple mats where indicated. Do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and floor conditions for compliance with requirements for location, sizes, minimum recess depth, and other conditions affecting installation of floor mats and frames.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Mats: Verify size of floor recess before fabricating mats.

B. Vacuum clean floor.

3.03 INSTALLATION

A. Install frames to achieve flush plane with finished floor surface and comply with manufacturer's written instructions.

B. Coordinate top of mat surfaces with bottom of doors that swing across mats to provide clearance between door and mat.

C. Install walk-off surface in floor recess flush with finish floor after cleaning of finish flooring.

1. Install necessary shims, spacers, and anchorages for proper location and secure attachment of frames.
2. Install grout and fill around frames and, if required to set mat tops at proper elevations, in recesses under mats. Finish grout and fill smooth and level.

3.04 PROTECTION

A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Deliver and install auditorium chairs complete, with selflifting seat which raises automatically to a uniform 3/4 fold position.

1.02 DESIGN REQUIREMENTS

A. Comply with ADA (Americans with Disabilities Act) Rules and Regulations.

B. Fire Performance Characteristics of Upholstered Seating:

1. Provide upholstered auditorium and theater chairs in compliance with local and national requirements having jurisdiction over this part of Work.

2. Chairs provided shall have been tested and certified as complying with BIFMA Voluntary Upholstered Furniture Flammability Standard F11978 (rev. 1980) sponsored by the Business and Institutional Furniture Manufacturer's Association.

C. Chair Envelope: Consideration of seating efficiency, Building Code regulations, row length, knee room and patron access past seated persons dictates the provision of a chair with an envelope that is as tight as possible in both its occupied and unoccupied conditions, as follows:

1. The depth of the chair between the rear of the chair back to the front of the chair seat in its raised or unoccupied condition and/or the chair arms shall be no greater than 18 inches.

2. The distance between the rear of the chair to the front of the chair seat in its lowered or occupied condition shall be no greater than about 26 inches.

3. It is assumed that conditions 1 and 2 above are best satisfied with a chair back pitch of no greater than about 16 degrees.

D. Seating Layout: Design and install seating to conform with project requirements in manner that produces seating layout with standards spaced laterally in each row so that end standards are in alignment from first to last row, regardless of whether aisles converge or are of constant width, and with backs and seats varied in width so that sightlines are optimized.

1. Seating layout indicated on Drawings is for illustrative purposes, conveying design intent.

1.03 SUBMITTALS

A. Product data for the type of fixed audience seating specified.

B. Shop drawings prepared indicating layout of seating units, chair sizes, and aisle widths; include actual field measurements.

C. Samples for initial selection purposes in form of manufacturer's color charts or samples of actual materials showing full range of standard colors, finishes, patterns, and textures available for each exposed material.

D. Samples for verification purposes of each exposed material from which seating units and accessories are composed, in each color, finish, pattern, and texture indicated; include samples of the following:

1. Fabric.

2. Plastic laminate.

3. Baked enamel finishes for metal components.

4. Integral color plastic parts.

5. Exposed fasteners.

6. End standards shall be cantilevered with wood veneer.
7. Armrests shall be finished hardwood.

E. FullSize Samples:

1. Contractor shall be prepared to submit a sample of each seating offered, which is truly representative in all particulars to the product he will deliver, if alternative seating is accepted.
2. The sample is a prerequisite part of and condition of acceptance of alternative seating, and failure to present samples within five days from date requested shall be considered sufficient reason for rejection.
3. Samples to be submitted shall consist of a complete chair with two end standards, a separate center standard and cutaway hinge.
4. All samples shall be delivered as directed by the Architect with all costs to be prepaid.
5. After inspection, the Contractor may pick up samples, if he so stipulates.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Engage a manufacturerapproved, locally based, experienced installer who regularly installs and services auditorium and theater seating similar in kind, quality, and extent to that indicated for Project.

B. Single Source Responsibility: Obtain each type of auditorium and theater seating from a single manufacturer, including accessories, and mounting and other installation components.

C. Field Constructed MockUp: Prior to installation of seating, erect mockup consisting of two chairs representing extremes of width to be provided; include at least one aisle unit; build mockup to comply with the following requirements:

1. Locate mockups on site in location and of size indicated or, if not indicated, as directed by Architect.
2. Obtain Architect's acceptance of mockups before beginning production of seating for Project.
3. Retain and maintain mockups during construction in undisturbed condition as a standard for judging completed seating.
4. When directed, demolish and remove mockups from Project site.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store seating in dry location protected from damage and soiling under environmental conditions acceptable to manufacturer.

B. Handle seating in a manner to prevent damage.

1.06 PROJECT CONDITIONS

A. Examine Work in place on which seating Work is dependent; defects which may influence satisfactory completion and performance of seating Work shall be corrected in accordance with the requirements of the applicable section of Work prior to commencement of seating Work.

B. Field Measurements:

1. Take field measurements to verify or supplement dimensions indicated.
2. Be responsible for accurate fit of Work.

C. Environmental Conditions: Do not install seating until space is enclosed and weatherproof, wetWork in space is complete and nominally dry, installation of finishes, including painting, is complete, other units of Work above ceiling are complete and ambient temperature and humidity conditions will be continuously maintained at values near those indicated for final occupancy.

1.07 WARRANTY

A. Manufacturer's Product Warranty: Submit manufacturer warranty form for fixed upholstered chairs.

1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 AVAILABLE MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Citation Chair by Irwin
2. Quattro Chair System by Hussey Seating; modified to be steel standards.
3. Concerto by KI.

2.02 MATERIALS

A. Gray Iron Castings: ASTM A 48, Class 25.

B. Steel Plates, Shapes, and Bars: ASTM A 36.

C. Electrolytic ZincCoated Steel Sheet: ASTM A 591, commercial and drawing quality, Coating Class C, chemically treated for bakedenamel finish; 0.0396 inch minimum thickness unless otherwise indicated.

D. DrilledIn Expansion Anchors: Expansion anchors complying with FX FFS325, Group VIII (anchors, expansion (nondrilling), Type I (internally threaded tubular expansion anchor) and machine bolts complying with FS FFJB575, Grade 5, with type and size selected by manufacturer to suit substrate and installation conditions indicated.

E. Molded Polyurethane Foam Padding:

1. Seat and back padding material shall be of new (prime manufacture) polyurethane foam.
2. Padding material shall comply with the flammability requirements outlined in California Technical Information Bulletin #117, Resilient Cellular Materials, Sections A and D, dated February 1975, when tested in accordance with Federal Test Method Standard 191, Method 5903.2.

F. Exposed Hardwood Lumber: Standard hardwood species, selected for freedom from visible defects, as standard with manufacturer.

1. Red Oak.

G. Plywood, exposed or concealed, shall be hardwood.

1. Interior plies shall be Class 3 or better; exposed exterior plies shall be Class 1.
2. All plywood shall be hot press laminated using high frequency process.

H. Particleboard core shall be 55pound density.

I. Fabric:

1. Upholstery fabric shall of 100% solutiondyed, bulked continuousfilament polyolefin yarn, Olympia pattern by National Contract Associates, minimum weight 19 oz. per lineal yard, minimum of 13 ends and 13 picks per inch.
2. Fabrics shall exhibit superior color fastness, light fastness, tear strength, and break strength and shall be exceptionally resistant to staining, chemicals, and abrasion, and shall offer a 10year warranty by fabric manufacturer.
3. Fabrics shall meet Class 1 flammability requirements of the U.S. Department of Commerce Commercial Standard 19153 per Bulletin #117 (California Code).

J. Injection Molded Plastic:

1. Plastic shall be onepiece high impact, linear polyethylene with built in ultraviolet light inhibitors to retard fading.
2. Plastic shall have a burn rate of 1 inch per minute when tested in accordance with ASTM D635.

2.03 FINISH

A. Metal Parts:

1. All exposed metal parts shall be powder coated with a hybrid powder coat finish.
2. The powder coat finish shall be applied by electrostatic means to a thickness of 23 mils, and shall provide a durable coating having a 2H Pencil hardness.
3. Prior to powder coating, metal parts shall be treated with a fivestage bonderization process for superior finish adhesion, and after coating shall be oven baked to cause proper flow of the epoxy powder to result in a smooth durable finish.
4. Manufacturer's standard color range shall be used.

B. Wood Parts: All exposed surfaces shall be stained to color selectedand coated with lacquer of sufficient film depth to afford wear resistance of institutional quality and oven baked.

C. Plastic Parts: Color of plastic shall be selected from manufacturer's standard color range.

D. Hardware: All assembly hardware shall be rust resistant, black plated.

E. Plastic Laminate:

1. Plastic laminate shall be composed of a core of kraft papers impregnated with phenolic resins, a decorative surface sheet, and overlay sheet containing melamine.
2. Layers are fused together under pressures in excess of 1,000 psi and temperatures over 275 degrees.
3. Plastic laminate shall meet or exceed performance standards as established by NEMA.
4. Thickness:
   a. Horizontal Surfaces: 0.050.
   b. Vertical Surfaces: 0.030.

F. Colors: To be selected from manufacturer's standard.

2.04 FABRICATION GENERAL

A. Fabricate auditorium seating units in contoured form for maximum comfort, using materials, which are carefully selected to be free of defects, objectionable projections, or irregularities.

B. Smoothly round corners, edges, and exposed fasteners, to present least possible snagging and pinching hazards.

C. Fabricate chair backs of seating rows located immediately in front of cross aisles on sloped or tiered floors so that back heights are not less than dimension indicated below, measured from walking surface of cross aisle immediately behind seating.

2.05 MOUNTING

A. Floor Mounting: Fabricate seating units for attachment to the floor slope using standards, which have been manufactured to attach to concrete.

2.06 METAL AISLE STANDARDS

A. Aisle Standards:

1. Pedestal design fabricated from minimum 16 gage steel.
2. Standards shall be fabricated of minimum 16 gage steel to a welded rectangular column.
3. The top of the column shall be provided with two formed steel dovetail lugs for secure attachment of armrests.
4. Brackets for seat attachment shall be of minimum 7 gage steel welded to standard.
5. Decorator Panel Upholstered Seating: Particleboard core surfaced with plastic laminate; match Architect's sample.
6. Aisle Lights: Operate from 24 volts requiring a transform system provided by the seating manufacturer. Low Voltage system approved by Underwriters Laboratories, Inc. Aisle lights to be mounted into the end panel or aisle standard; furnished with a cover as integral part of standard/panel.

B. Floor Mounting:

1. A formed minimum 16 gage steel foot shall be welded to the bottom of the rectangular column.
2. Weldment shall be at all critical stress areas 360 degrees around the column and concealed on the inside, so as not to detract from the clean appearance.
3. The foot dimension shall be 8 inches x 23/4 inches to provide maximum bearing surface to the floor to withstand severe tightening and shock without fracture.
4. The standard shall be fabricated to be compatible with the floor incline, and to maintain proper seat and back height and angle.
5. Weldments shall be gas shielded, arc weld.

2.07 METAL CENTER STANDARDS

A. Center standards shall be of welded steel, modern pedestal design, fabricated of minimum 16 gage steel to a 1 inch x 3 inch rectangular column.

B. Brackets for seat support shall be minimum 7 gage steel for superior strength formed with an integral support buttress, and wing plates for mounting backs shall be minimum 16 gage steel; both MIG welded to the pedestal column shall be provided with two formed steel dovetails for secure attachment of the armrests.

C. Floor Mounted Chairs:

1. A formed minimum 16 gage steel foot shall be welded to the bottom of the rectangular column.
2. Weldment shall be at all critical stress areas 360 degrees around the column and concealed on the inside, so as not to detract from the clean appearance.
3. The foot dimension shall be 8 inches x 23/4 inches to provide maximum bearing surface to the floor to withstand severe tightening and shock without fracture.
4. The standard shall be fabricated to be compatible with the floor incline, and to maintain proper seat and back height and angle.
5. Weldments shall be gas shielded, arc weld.

2.08 MOVABLE BASES

A. To provide for mobility of a given number of chairs shown in the auditorium, chairs located as shown in the Drawings shall be mounted upon moveable steel bases.

B. The steel bases shall accommodate sections of one, two or three chairs.

C. The bases shall be fabricated to manufacturer's standard; welded construction.

D. Holes shall be provided for the attachment of the standards.

2.09 UPHOLSTERED CHAIR CONSTRUCTION

A. General:

1. Fabricate fixed audience seating with padding and fabric covering.
2. Equip each seat with manufacturer's standard selfrising seat mechanisms so that unoccupied seats return to raised position for maximum passing room.
3. Construction:
    a. Backs shall be padded and upholstered, consisting of a onepiece injection molded plastic outer panel, and a 7/16 inch 5ply hardwood inner upholstery panel.
    b. The outer panel shall be injection molded plastic, high impactresistant with textured outer surface, formed to enclose the edges of the inner upholstery panel at the top and both sides of the back, and shall be not less than 26 inches in length, extending below the seat level to protect the seat cushion.
4. Attachment:
    a. There shall be no exposed screws above the armrests. Backwings for attaching the back to the standards shall be minimum 14 gage (0.0747 inch) steel, secured to the inner panel by the use of four machine screws threaded into four threaded washers.
    b. Backwings shall have provision for 16 degree, 20 degree or 24 degree pitch.
5. Upholstery:
    a. The upholstery materials shall be placed over a 2 inch thick polyfoam pad.
    b. The polyfoam pad shall be securely cemented to the plywood inner panel and the upholstery fabric shall be securely fastened to the hardwood inner panel by means of upholstery staples to facilitate ease of reupholstering.

B. Chair Seats:

1. Seats shall be of the upholstered contoured plywood suspension type construction including a waterfall front edge. Seats shall consist of an upper portion consisting of a 5ply minimum plywood base over which padding materials and cover shall be applied. The upper portion of the seat shall be readily removable for reupholstery.
2. The molded plywood base shall be upholstered as follows: Over the base shall be applied a polyurethane foam topper pad, 3” contoured foam, which shall be adhered to the ergonomically profiled plywood base. The cover shall be applied over all of the padding material. The cover shall be secured to the underside of the seat base. The fabric cover shall be of a single piece of material.
3. The seat pan shall be of onepiece, high density polyethylene, polypropylene or equivalent of not less than 3/16” nominal thickness. The closeout shall be throughcolored, textured and selected from a standard range of manufacturer’s colors. The closeout shall be tight to the edge of the base of the upholstered top shall have a smooth edge to eliminate any possibility of snag hazards.
4. The seat shall rotate on two selfcompensating, fully independent, 5/8 inch diameter, high strength, solid steel hinge rods.
5. Seatlift shall be accomplished by dual minimum 13 gage extension springs, providing quiet seat uplift, seat uplift shall be dampened at the 3/4 fold position.

2.10 ARM RESTS

A. Hardwood Armrest:

1. Armrests shall be solid hardwood with all edges well rounded, and shaped to provide a design compatible with other chair components.
2. Armrests shall be furnished with two (2) keyhole slots in the bottom, and shall lock securely to dovetail lugs provided on aisle and center standards.
3. Armrests shall be provided with one (1) security screw inserted from the bottom side to discourage tampering.
4. Hardwood armrests shall be available with natural finish, stained, or decorator lacquered to match other chair components.

2.11 ACCESSORIES

A. Tablet Arm:

1. Size: 11 3/4 inches by 10 1/4 inches with rounded corners.
2. Top and bottom surfaces to be high pressure laminate over solid core plywood.
3. Tablet arm to store within users chair beneath the arm rest.
4. Location: Where indicated on the drawings.

B. Row Letter and Chair Number Plates:

1. A numbering system shall be provided for identification of all chairs.
2. Number and letter plates shall be furnished as shown on the approved seating layout.

2.12 HANDICAPPED ACCESS AISLE STANDARDS

A. Aisle standards designated on the Drawings shall be arranged for easy access by handicapped individuals and shall be designed to allow the individual to transfer easily from a wheelchair to the theatre chair.

1. The aisle standard support column shall be inclined to the rear at the top by 16 degrees.
2. Aisle standard shall be equipped with an armrest capable of lifting to a position parallel with the chair back, opening sideways access to the seat.
3. Aisle standards so equipped shall be provided with a label, displaying an easily recognizable "handicapped" symbol.

2.13 MAINTENANCE MATERIALS

A. Replacement Seat and Back Covers Upholstered Chairs:

1. A quantity of cut and sewn seat and back upholstery covers shall be provided with the upholstered auditorium chairs.
2. Covers shall be produced at the same time, using identical fabric as materials for chair construction and shall be presented, properly packaged, to the Owner upon completion of the seating installation.
3. Size of covers shall be prorated according to sizes of chairs in the seating layout.
4. Quantity of covers to be provided shall be sufficient to reupholster 5 percent of chairs.

B. Provide ten yards of additional fabric.

C. Replacement Armrests: Provide one pair of armrests for every 20 new seats (or portion thereof), of each type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with installer present, for compliance with requirements for construction tolerances, material properties as they affect anchors and fasteners.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Installation of seating shall be performed by manufacturer’s regularly authorized installer.

B. Locate seating in locations indicated on approved shop drawings, with required clearances, elevations, and sight lines.

C. Install standards in locations conforming to seating layout, with each standard attached to substrate by not less than 2 anchoring devices of size and type required to produce chairs free from rock or instability under conditions of actual use.

D. Install chairs by mounting components to standards or brackets mounted on standards, using manufacturer's recommended hardware and fasteners; ensure that chairs in curved rows are installed at proper radius, and verify that moving components operate smoothly and quietly.

E. Coordinate mounting with floor finish Work.

3.03 ADJUSTING

A. Adjust selfrising seat mechanisms as required to assure that seats in each row are aligned when in upright position.

B. Touchup minor abrasions and imperfections in painted finishes with coating with matched factory applied finish.

C. Replace any upholstery, which has been damaged in installation.

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes wall-attached telescoping stands.

1.02 DESIGN REQUIREMENTS

A. Telescopic gymnasium seating will be designed to support a vertical live load of 100 pounds per square foot, but not less than 120 pounds per lineal foot on both seat boards and footboards; seating shall also be designed to carry a horizontal sway force of 24 pounds per lineal foot parallel to the seating and 10 pounds per lineal foot perpendicular to the seating.

B. No section length greater than 25'-6" is permitted.

1.03 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for telescoping stands.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples for Initial Selection: For each type of exposed finish required.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Decking: 3-inch- square samples of finished material.
2. Metal Components: 3-inch- square sample of each color and finish indicated.
3. Seating: 3-inch- square sample of each seating material and finish indicated.

E. Qualification Data: For Installer.

F. LEED Report: Accurately document the use of recycled materials and local/regional materials.

G. Operation and Maintenance Data: For telescoping stands to include in emergency, operation, and maintenance manuals.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Manufacturer's Engineering Responsibility: Preparation of data for telescoping stands, including Shop Drawings, and comprehensive engineering analysis by a qualified professional engineer.

C. Safety Standard: Provide telescoping stands that comply with requirements in NFPA 102.

D. Welding: Qualify procedures and personnel according to AWS D1.1 "Structural Welding Code - Steel" and AWS D1.3 "Structural Welding Code - Sheet Steel."

E. Accessibility Requirements: Provide telescoping stands that comply with requirements in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)".

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.05 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls, columns, and other construction that will interface with telescoping stands by field measurements before fabrication and indicate measurements on Shop Drawings.

1.06 EXTRA MATERIALS

A. Provide eight extra seats.

1.07 WARRANTY

A. Manufacturer's Product Warranty: Submit manufacturer's standard warranty form for telescoping bleachers. This warranty is in addition to, and not a limitation of other rights Owner may have under Contract Documents.

1. Warranty Period: Five years from Date of Acceptance.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Hussey Seating Company.
2. Interkal LLC.
3. Irwin Folding Bleacher Company.

B. Design to incorporate recoverable seat units at handicapped locations:

1. Hussey Seating Company; Flex Row.
2. Interkal LLC; Vari-Row.
3. Irwin Folding Bleacher Company; MDU.

2.02 MATERIALS

A. Wood:

1. Plywood: APA grade trademarked, DOC PS 1.

B. Steel:

1. Structural Steel Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 coating designation.
3. Uncoated Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold-rolled commercial steel), or ASTM A 1011/A 1011M, Designation CS (hot-rolled commercial steel).
4. Tubing: ASTM A 500, cold formed; ASTM A 501, hot formed; or ASTM A 513, mechanical.

C. Extruded Aluminum: ASTM B 221, alloy as standard for manufacturer.

D. Polyethylene Plastic: High-density polyethylene; molded, color-pigmented, textured, impact-resistant, structural formulation.

2.03 TELESCOPING STANDS

A. Description: Operable systems of multiple-tiered seating on interconnected folding platforms that close, without being dismantled, into a nested stack for storing or moving. Stand units permit opening and closing of adjacent rows, allow individual and collective rows to be locked open for use, and close with vertical faces of upper skirts on the same vertical plane.

B. Wall-attached Telescoping Stands: Rear of understructure permanently attaches to wall construction.

C. Operation - Gymnasium: Manually operated with one pair of operating handles.

D. Depth per Row: (measured horizontally from front edge of one seaboard to front edge of the next seaboard) 22"

E. Tiers:

1. As indicated on the drawings.

F. Net Capacity:

1. As indicated on the drawings.

G. Row Rise: As indicated on the drawings.

H. Aisle Width: 3 at 4'-6" per bleacher

I. Bench Seats and Skirts:

1. Material: Molded polyethylene plastic with contour seat surface.

a. Colors: As selected by Architect from manufacturer's standard.

2. Bench Modules: 18 inches long unitized, interlocking, engineered, high density injection molded polyethylene modules providing scuff-resistant textured 10 inch wide anatomically contoured seat surface, with face designed to accept seat number plates. Seat and face shall incorporate a 2 inch minimum interlock.

3. Profile: Designed with internal reinforcement ribs and cantilevered to the rear to provide not less than 3 inches smooth toe space beneath the seat.

4. End Caps:

a. Each end of row shall be enclosed with matching end caps.

b. End caps shall be designed with concealed attachment and provide indent for row letters.

c. Color to match seat top.

5. Telescopic seating shall have a minimum seat height of 16-1/2" from seat to platform deck.

6. Recoverable units at handicapped locations.

J. Deck: Plywood.

1. Finish: Two coats of polyurethane to provide a clear transparent finish.

K. Risers: Steel sheet with manufacturer's standard rust-inhibiting coating or hot-dip galvanized finish.

L. Rails: Structural steel, finished with manufacturer's standard powder coat system.

1. Color: To match seats, no exceptions.

M. Understructure: Structural steel.

1. Finish: Manufacturer's standard rust-inhibiting finish.

2. Color: Manufacturer's standard.

N. Support Column Wheels: Nonmarring, soft, rubber-face wheel assembly under each support column.

1. Include wheels of size, number, and design required to support stands and operate smoothly without damaging the flooring surface, but not less than four per column or less than 3-1/2 inches in diameter and 1 inch wide.

O. Fasteners: Vibration proof, in manufacturer's standard size and material.

P. Accessories:

1. Slip-resistant, abrasive tread surfaces at vertical aisles.
2. Intermediate aisle steps, fully enclosed, at each vertical aisle.
3. Store-in-place Aisle Handrails: Provide single pedestal mount handrails 34 inches high with terminating mid-rail.
    a. Nose-mounted.
    b. Closed-loop handrail.
4. End rails (guards) that are telescoping and self-storing.
5. Rear fillers including supports for closing openings between top row and rear wall of adjoining construction.

2.04 FABRICATION

A. Fabricate understructure from structural steel members in size, spacing, and form required to support design loads specified in referenced safety standard.

B. Weld understructure to comply with applicable AWS standards.

C. Round corners and edges of components and exposed fasteners to reduce snagging and pinching hazards.

D. Form exposed sheet metal with flat, flush surfaces, level and true in line, and without cracking and grain separation.

E. Seating Supports: Fabricate supports to withstand, without damage to components, the forces imposed by use of stands without failure or other conditions that might impair the usefulness of seating units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas where telescoping stands are to be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install telescoping stands to comply with referenced safety standard and manufacturer's written instructions.

3.03 ADJUSTING AND CLEANING

A. On completion of installation, lubricate, test, and adjust each telescoping stand unit so that it operates according to manufacturer's written operating instructions.

B. Clean installed telescoping stands on exposed and semiexposed surfaces. Touch up shop-applied finishes or replace components as required to restore damaged or soiled areas.

3.04 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain telescoping stands. Refer to Division 1 Section "Demonstration and Training."

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall-mounted folding cafeteria tables with benches and wall storage pockets.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: Reporting requirements for VOC content.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate fabrication and installation schedule to avoid delaying the work.

1.04 REFERENCE STANDARDS

A. AWS D1.1/D1.1M - Structural Welding Code - Steel 2015, with Errata (2016).

B. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel 2018.

C. UL (GGG) - GREENGUARD Gold Certified Products Current Edition.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's product data and installation instructions for each type of unit specified, including materials, dimensions of components, shapes, and finishes.

C. Shop Drawings: Show details of actual units for the project, including plans, elevations, sections, details of components, profiles, and finishes.

D. Samples for Selection of Colors:

1. Manufacturer's Color Charts: Actual units or sections of the units showing the full range of colors, textures and patterns available for each exposed material involving color choice.
2. High-pressure Plastic Laminate: Samples from the same material to be used for the work.
3. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

E. Installer's Qualification Statement.

F. Warranty documents.

G. Maintenance Data: Include detailed operation and maintenance procedures.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Installer experienced in installing built-in tables and seating similar to those required for this project.

1. Certified by the manufacturer of the built-in table/seating system to perform the work.

B. Welder Qualifications: Satisfactorily passed AWS qualifications.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

B. Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by manufacturer.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer's Warranty: Submit manufacturer's standard warranty document executed by authorized company official.

C. Warranty Coverage: To include replacement or repair of any defect on the original material and workmanship, including welds, pockets, tables and benches.

D. Warranty Period: 15 years from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 CAFETERIA TABLES AND BENCHES

A. Cafeteria Tables and Benches: Tables with companion bench seats that fold in the middle lengthwise into wall-mounted storage pockets; unitized understructure not requiring the tops of benches for operation.

1. Design Criteria: Bench undercarriage capable of supporting 200 pounds (91 kg) at any point when top panels are removed.
2. Tables and benches detachable from and interchangeable in storage pockets.
3. Equipped with compression springs to ensure proper counterbalance in any position.
4. Locking automatically when folded into pocket for storage, with field adjustable down latches.
5. Self-actuating safety latches that engage automatically when table/bench is closed.
6. Key operated mullion locks to prevent unauthorized use.
7. Exposed surfaces free of lock holes.
8. Lock Bolts: Two sets: 1/2 inches (13 mm) diameter, solid steel lock bolts:
    a. One set of pins manually activated by means of a remote handle positioned near the center of each table and bench.
    b. Second sets of pins automatically engaged while closing the table and bench.
9. Sheet Steel Welding: In accordance with AWS D1.3/D1.3M.
10. Steel Shapes Welding: In accordance with AWS D1.1/D1.1M.

B. Table Dimensions:

1. Length: 165-1/2 inches (4202 mm).
2. Height: 27 inches (686 mm).
3. Width: 29-1/2 inches (749 mm).

C. Bench Dimensions:

1. Length: 165-1/2 inches (4202 mm).
2. Height: 15 inches (381 mm).
3. Width: 11-1/2 inches (292 mm).

D. Tabletop Frame: Dual 1-1/4 by 2-1/8 inch (32 by 54 mm), 14 gage, 0.075 inch (1.90 mm) steel box channels.

E. Bench Frame: Dual 1-1/2 inch (38 mm), 16 gage, 0.060 inch (1.52 mm) steel angle with returned edges rolled to 11 gage, 0.12 inch (3 mm).

F. Table Top and Bench Construction:

1. Top Panels: 3/4 inch (19 mm) thick, resin wood with density of 45 per cubic foot (721 kilogram per cubic meter).
2. Top Surface Finish: Manufacturer's standard vertical grade high pressure plastic laminate; laminate backing sheet on opposite surface.
3. Finish Color: As selected by Architect from manufacturer's standard colors.
4. Table Edges: Manufacturer's standard bonded polyurea.

G. Tubular Members:

1. Stretcher Bar: 16 gage, 0.060 inch (1.52 mm) diameter steel tubing.
2. Bench End Legs: 16 gage, 0.060 inch (1.52 mm), 1 inch (25.4 millimeter) diameter steel tubing.
3. Center Leg Assembly:
   a. Outer Telescoping Tube: 14 gage, 0.075 inch (1.90 mm), 1-3/8 inch (35 millimeter) diameter steel tubing.
   b. Inner telescoping tube: 14 gage, 0.075 inch (1.90 mm), 1-1/8 inch (29 millimeter) diameter steel tubing.

H. Steel Finish: Epoxy powder coat.

I. Wheels: Manufacturer's standard non-marking wheels.

2.02 WALL STORAGE POCKETS

A. Rough Opening Dimensions:

1. Surface-Mounted:
   a. Single Table:
      1) Height: 89-7/8 inches (2283 mm).
      2) Width: 61-5/8 inches (1565 mm).
      3) Depth: 5-15/16 inches (151 mm).
   b. Double Table:
      1) Height: 89-7/8 inches (2283 mm).
      2) Width: 61-5/8 inches (1565 mm).
      3) Depth: 11-1/2 inches (292 mm).
2. Recessed:
   a. Single Table:
      1) Height: 86-1/2 inches (2197 mm).
      2) Width: 60 inches (1524 mm).
      3) Depth: 6 inches (152 mm).
   b. Double Table:
      1) Height: 86-1/2 inches (2197 mm).
      2) Width: 60 inches (1524 mm).
      3) Depth: 11-1/2 inches (292 mm).

B. Storage Pocket Construction: Steel sheet box, fully welded, with solid back, sides, top and bottom.

1. Material: Sheet steel, 16 gage, 0.060 inch (1.52 mm) unless otherwise indicated.
2. Sill and Top Plates: 11 gage, 0.12 inch (3 mm) sill and top plates.
3. Head Panel: 2-1/2 inches (64 mm) vertical facing to cover masonry opening of 86-1/2 inches (2197 mm).
4. Recessed Pockets: Provide 2 inches (51 mm) side facing to overlap walls.
5. Anchor Holes: Provide at base and back of pocket for fastening unit to floors and walls.
6. Finish: Phosphate coated with sprayed-on epoxy paint with hardener.
7. Finish Color: As selected by Architect from manufacturer's standard colors.
8. Strap Anchors: Provide for pockets built into masonry walls.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and surfaces where units are to be installed.

B. Ensure compliance with installation tolerance requirements and other conditions affecting performance.

C. Verify that floor surface under fully expanded units is level with no more than 1/8 inch (3 mm) change in height over 10 foot (3 meters).

D. Verify that rough walls at pocket locations are plumb.

E. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Protect previously installed finish materials from damage during installation .

B. Make actual field measurements prior to fabrication and show field measurements on shop drawings.

3.03 INSTALLATION

A. Install units in compliance with manufacturer's instructions and shop drawings.

B. Install with top of pocket sill plate within 1/16 inch (1.5 mm) of top of finished floor level.

C. Provide accessories indicated, including anchors, fasteners, inserts, and other hardware required for installing and attaching units to adjoining construction.

D. Secure sill level on floor with flat-head screws through each hole provided by manufacturer; use lead or patent-type anchors for concrete floors; install screw heads flush with sill.

3.04 ADJUSTING

A. Restore damaged and soiled areas by touching up factory finish to like-new condition.

B. Lubricate, test, and adjust each unit for smooth and easy operation and proper adjustment of controls and safety features In accordance with manufacturer's recommendations.

3.05 CLEANING

A. After installation and adjustment, clean exposed and partially exposed surfaces of each installed unit. Use materials recommended by manufacturer.

3.06 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Demonstrate operation of units to Owner 's personnel.

1. Use maintenance data as reference during demonstration.
2. Briefly describe function, operation, and maintenance of each component.
3. Review inspection, service, and maintenance requirements and identify service personnel contact information.

3.07 PROTECTION

A. Protect installed units from damage during subsequent construction.

B. Ensure that units are without damage or deterioration upon Date of Substantial Completion.

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Provide structural design, labor, material, equipment, and supervision necessary to complete installation of permanent steel pre-engineered grandstands and observation booth and baseball/softball portable bleachers, including, but not limited to the following:

1. Steel Substructure
2. Decking System
3. Exit Steps and Handicap Ramps
4. Safety Rails with ChainLink Fence attached
5. Concrete Foundation System
6. Observation Booth Support Structure
7. Observation Booth
8. Façade closure panels

1.02 PERFORMANCE REQUIREMENTS

A. Structural Performance Characteristics: Engineer, fabricate, and install grandstands, bleachers, and press box capable or withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Wind Loads: Determine loads based on the following minimum design wind pressures:
    a. Uniform pressure as required by local authorities having jurisdiction.
2. Snow Loads: As required by local authorities having jurisdiction.
3. Live Loads: 100psf gross horizontal area.
4. Perpendicular Sway Load: 10lbs/lin ft of seat plank.
5. Lateral Sway Load: 24lbs/lin ft of seat plank.
6. Live Load for Seat and Tread Planks: 120lbs/lin.ft to seats and footboards.
7. Top Rails of Guardrails:
    a. Uniform load of 50lbf/ ft. applied in any direction.
    b. Concentrated load of 200lbf applied in any direction.
    c. Uniform and concentrated loads need not be assumed to act concurrently.
8. Infill of Guardrails:
    a. Concentrated load of 50lbf applied horizontally on an area of 1 sq. ft.
    b. Infill load and other loads need not be assumed to act concurrently.

B. Thermal Movements: Provide grandstands and bleachers that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

C. Detailing, fabrication, and installation of grandstands and bleachers shall be in accordance with AISC Specifications for Aluminum Structures.

D. Shop Connections: Welded and capable of carrying stress put upon them.

E. Welding: Comply with AWS Standards.

1.03 SUBMITTALS

A. Manufacturer's Product Data: Submit manufacturer's descriptive product data for project.

B. Shop Drawings: Prepared by or under the supervision of a Registered Professional Engineer, in the Commonwealth of Virginia, detailing fabrication and assembly of grandstands, bleachers, and press box, as well as procedures and diagrams. Submit shop drawings indicating layout of grandstand and bleacher seating systems coordinated with field measurements and including seat heights, row spacing and rise, aisle widths and locations, overall dimensions, connections and relationship to adjoining work, accessories, types of materials and finishes.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

2. Surveyor, at the expense of contractor, shall verify existing conditions prior to submittal drawings. Survey shall be submitted as part of submittal process.

C. Geotechnical Report.:The grandstand manufacture shall employ the services of a geotechnical engineer, registered in the Commonwealth of Virginia for the purpose of determining the soil conditions at the locations where the grandstands are to be installed. A certified copy of the geotechnical report must be provided with the grandstands shop drawing submission.

D. Welding certificates.

E. Manufacturer Certificates: Signed by manufacturers certifying that they comply with requirements.

F. Qualification Data: For Installer.

G. Field Quality-Control Report: Indicate compliance of installed grandstand, bleachers and press box and components with requirements.

H. Maintenance Data: For each product to include in maintenance manuals.

I. Warranties: Special warranties specified in this Section.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturers must have ten years of experience in the manufacture of bleachers and grandstands; welders must be AWS certified. All grandstand observation booth and portable bleacher manufactures are required to provide written verification that their product is approved by all Loudoun County, VA. permitting and inspecting agencies prior to submittals.

1. Manufacturer’s responsibilities include providing professional engineering services for designing grandstands, bleachers, and press box to comply with performance requirements.

B. Installer Qualifications: Engage an experienced Installer to perform the Work of this Section who has specialized in installing types of grandstands similar to those required for this Project and who is acceptable to, or certified by, manufacturer of grandstands.

C. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in the Commonwealth of Virginia and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of grandstands and bleachers that are similar to that indicated for this Project in material, design, and extent.

D. Source Limitations: Obtain grandstands and press box through one source from a single manufacturer.

E. Source Quality Control:

1. Mill Test Certification.
2. Code Compliance:
    a. IBC 2006 - International Building Code compliance is required for all construction. Written verification is required as part of the submittal and required to be labeled on the observation booth.
    b. ICCEC compliance and UL labeling is required for all electrical construction. Written verification is required as part of the submittal and required to be labeled on the observation booth.
    c. ICC/ANSI 300 - Bleachers, Folding and Telescopic Seating and Grandstands.

F. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code--Aluminum."

G. Accessibility Requirements: In addition to local governing regulations, comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act Architectural Guidelines (ADA), Accessibility Guidelines (ADAAG)."

H. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

I. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201.

J. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1.

1.05 PROJECT CONDITIONS

A. Field Measurements: Surveyor, at the expense of contractor, shall verify existing conditions prior to submittal drawings. Recorded measurements will be shown on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.06 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of grandstand that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:

1. Structural failures including, but not limited to, excessive deflection.
2. Failure of system to meet performance requirements.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

B. Warranty Period: One year from date of Substantial Completion.

C. Warranty Period for Metal Finishes: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Dant-Clayton Corporation.
2. Southern Bleacher Company.
3. Sturdisteel Co.
4. Outdoor Aluminum Inc.

2.02 PERMANENT GRANDSTANDS AND BLEACHERS

A. Materials:
   1. Steel: ASTM A 36.
   2. Aluminum: Extruded alloy 6063-T6.
   3. Foundation Concrete: Minimum compressive strength of 3000psi at 28 days.
   4. Accessories:
      a. Steel Connections: ASTM A 307, galvanized.
      b. Aluminum Components: ASTM A 307, cadmium plated.
      c. Hold-Down Clip Assembly and End Caps: Aluminum Alloy 6063-T6.

B. Steel Members:
   1. Stringers: 6 feet o.c.
   2. Columns: Spaced at 18 feet o.c. longitudinal.
   3. Cross Braces: Steel angles.

C. Guardrail System: Provide guardrails at all sides of grandstands, entry stairs, ramps, and landings.
   1. Material: Anodized aluminum pipe, with end plugs at ends of straight runs and elbows at corners. Secure to angle rail risers with galvanized fasteners.
   2. Top Railing: 42 inches above walkways, entrances, and above center of any adjacent seat.
   3. Chain Link Infill on Side and Back: 6 gage black vinyl coated, galvanized fabric fastened in place with galvanized fittings and aluminum ties.

D. Aluminum Seat boards: Nominal 2 inches by 10 inches, extruded aluminum with minimum wall thickness of 0.094 inches. Matching aluminum end caps shall be furnished at aisles and ends of grandstand. All steel surfaces in contact with aluminum seats shall be treated to prevent electrolytic action. Seat boards shall be secured to their steel supports by means of extruded aluminum clips and 5/16-inch-diameter bolts. All splices shall occur at steel supports. Splices in other locations will not be permitted.

E. Aluminum Footboards: Size per component requirements, non-slip aluminum planks made of 6063-T6 aluminum alloys with minimum wall thickness of 0.094 inches. Footboards shall be secured to their steel supports by means of extruded aluminum clips and 5/16-inch-diameter bolts. All splices shall occur at steel supports. Splices in other locations will not be permitted.
   1. Deck System: Tongue & Groove 2001 Deck
      a. The tread system shall be comprised of aluminum extrusions which interlock or longitudinally welded together lengthwise. The interlocking mechanism or welded deck will minimize deflection and not separate due to loads being applied to individual planks.
      b. The system shall cause the deck planks to react together at all treads and walkways to live load and form the appearance of a single tread system. By design, this system forms a solid, overlapping tread and riser installation.
      c. The nose extrusion shall allow for a 1” extruded aluminum contrasting nose piece to be flush mounted on the leading edge and shall capture the vertical riser plank in an extruded pocket. The heel extrusion shall have a .70” vertical lip at the rear of the plank to allow for placement of vertical riser plank and inhibit fluids from escaping at the rear of the tread.
      d. These extrusions shall be such that the attachment of the seat brackets, step brackets, mid-aisle rails and all other components is accomplished without deck penetrations. No through bolting or drilling of the aluminum tread / riser system shall be permitted.

e. The system shall allow for seat and aisle reconfiguration at any time without evidence of its previous configuration.

f. Aluminum tread / riser system that allows fluids to be contained and gravity flow toward the first tread. This gutter will collect fluids and control them to specific areas.

F. Aluminum Risers: Aluminum planks made of 6063-T6 aluminum alloys with minimum wall thickness of 0.094 inches. Provide continuous aluminum riser closures between all footboards. Through bolting or drilling of the riser board is unacceptable.

G. Stairs: 2-by-12 inch aluminum treads with maximum 7-inch rise.

H. Hardware: All connections for seat boards, guardrails, and guardrail pipe shall be tamperproof and galvanized. Footboard connections shall be made with galvanized fasteners.

I. Concrete Footings: Footings for the grandstand shall provide sufficient bearing area at bottom to support all loads of the grandstand. The grandstand manufacturer is wholly responsible for the design of the footings. Depth and design of footings shall be determined by Owner supplied soil test. Hot-dipped galvanized anchor bolts shall be secured in the concrete footings. Concrete shall attain working strength of 3,000 psi.

1. Footings for the grandstand shall extend not less than 42" below grade, and provide sufficient bearing area at bottom to support all loads of the grandstand. Depth and design of footings shall be determined by local soil conditions. Hot-dipped galvanized 3/4" anchor bolts shall be secured in the concrete footings. Soil bearing pressure for bid purposes will be 2500 psf.

J. Bleacher Understructure: Manufacturer’s standard hot-dipped galvanized steel. Aluminum is unacceptable. Painted steel is unacceptable.

K. Façade closure panels: Pre-finished, non-corrosive panels capable of withstanding minimum impact strength of 40.0 ft/lbs in accordance with ASTM D3029-90.

L. Finishes:

1. Steel: Hot-dipped galvanized after fabrication in accordance with ASTM A 123.

2. Aluminum:

a. Seat boards: Clear anodized aluminum.

b. Aluminum Footboards: Mill finish.

c. Riser Boards: Clear anodized finish.

M. Component Requirements:

1. Permanent Grandstand Seating System at Football Field - Home Side.

a. Size and Capacity as indicated on the drawings.

b. Front Walkway elevation: 48”.

c. Front Walkway Width: 96 inches.

d. Footboard Decking System: Fully closed and interlocking

e. Riser boards: anodized.

f. Seat boards: 2 inches thick and 10 inches wide minimum.

g. Guardrail System at Front and Sides: Three rails with chain link fence, 42 inches high.

h. Handicapped Seating: As indicated on drawings.

i. Number of Handicapped Ramps: Two.

j. Egress stairs as shown on the drawings

2. Permanent Grandstand Seating System at Football Field – Visitor Side.
   a. Size and Capacity as indicated on the drawings.
   b. Front Walkway elevation: 48”.
   c. Front Walkway Width: 96 inches.
   d. Footboard Decking System: Fully closed and interlocking
   e. Riser boards: anodized.
   f. Seat boards: 2 inches thick and 10 inches wide minimum.
   g. Guardrail System at Front and Sides: Three rails with chain link fence, 42 inches high.
   h. Handicapped Seating: As indicated on drawings.
   i. Number of Handicapped Ramps: Two.
   j. Egress stairs as shown on the drawings
3. Non-Elevated Bleacher Seating System at miscellaneous fields.
   a. 33’-0” x (10) rows, capacity 177
   b. Footboard Decking System: Semi-closed
   c. Riser boards: anodized.
   d. Seat boards: 2 inches thick and 10 inches wide minimum.
   e. Guardrail System at Front and Sides: Three rails with chain link fence, 42 inches high.
   f. Handicapped Seating: As indicated on drawings.

2.03 PREFABRICATED OBSERVATION BOOTH

A. Design: All materials shall be new and shall comply with the requirements ASTM specifications. The prefabricated observation booth must be constructed in accordance with IBC 2006 - International Building Code construction "Type VB", IMC, IPC, ICCEC and all state and local codes.

B. Product Description:
   1. Press Box Support Structure: Hot dipped galvanized steel columns and I beams as shown on the contract drawings attaching to concrete foundations.
   2. Press Box Dimensions: 8 feet wide x 36 feet long.
   3. Press Box to be constructed in accordance of approved drawings.
   4. Press Box manufacturer must be registered with the State of Virginia Department of Housing and Urban Development as an authorized supplier of Industrialized Buildings. Authorization must be based on construction methods as described in this section.

C. Materials/Finishes
   1. Press Box Support Structure:
      a. Structural shapes meet one of the following ASTM specifications: A36, A36/A572 grade 50, A572 grade 50, A529-50, or A500 grade B.
      b. Shop connections are seal welds.
      c. After fabrication, all steel is hot-dipped galvanized to ASTM-A-123 specifications.

2. Press Box: All materials shall be new and shall comply with ASTM specifications.
    a. Floor:
        1) Main support to be a galvanized steel floor frame sized to support structure and metal belly pan for support of insulation.
        2) Floor to be INTERLOCK Aluminum Decking System, extruded aluminum alloy 6063-T6, mill finish. Attach Decking System to steel floor frame with mechanical fasteners at end of plank and at intermediate supports. (Tongue & Groove or Standard extrusion is not acceptable.)
        3) Insulation: Kraft faced fiberglass building insulation R-11, 3 1/2 inches thick. Batt or roll as manufactured by Owens-Corning Fiberglass Corp., or equal.
    b. Wall Structure:
        1) 4 inch x 4 inch x 11 gauge square tubing with maximum span of 14 feet on front wall and maximum span of 6 feet on back wall and 4 inch x 2 1/2 inch x 14 gauge steel "cees" with maximum spacing of 5 feet for all walls with siding. Spans greater than these require engineered calculations for design. Front wall frame shall angle out from countertop as shown in the drawings.
        2) Insulation: Kraft faced fiberglass building insulation R-11, 3 1/2 inches thick. Batt or roll as manufactured by Owens-Corning Fiberglass Corp., or equal.
        3) Interior Finish:
            (a) Interior sheathing shall be 5/8" gypsum board, finish prepped, painted with 1 coat of primer and 2 coats of egg-shell, latex paint, color as selected by Architect. Note: Drywall installed after approved County close-in inspection.
            (b) Cove Base: Vinyl 4 inches x 0.080 equal to PRO CB-35 Nubian.
        4) Exterior Finish:
            (a) 26 gauge pre-finished R-Panel paneling as manufactured by MBCI, Signature 200 color series, or equal.
            (b) Wall panels are attached with #12 TEK screws - 6” O.C. at the top and bottom of the panels.
            (c) Lap screws are placed at each end of the panels, at the intermediate supports, and at the mid point between supports (TEK #14).
            (d) All fasteners to be painted same color as exterior paneling.
    c. Roof Structure:
        1) 4 inch x 4 inch x 11 gauge square tubing with maximum spacing of 6 feet on center and 4 inches x 2 1/2 inches x 14 gauge steel "cees" with maximum spacing of 2 feet on center.
        2) Roof: 1/8 inch four-way steel plate roof, continuous welded seams coated with acrylic metal primer and 36 mils of acrylik roof coating as manufactured by Isothermal Protective Coatings, or equal. Plate is welded on both sides of rafters with 1-1/2 inch long 1/8-inch fillet welds on 12-inch centers.
        3) Insulation: Kraft faced fiberglass building insulation, R-19 (minimum) 6 inches thick. Batt or roll as manufactured by Owens-Corning Fiberglas Corp., or equal.
        4) Cornice: 26-gauge steel pre-finished to match metal siding.

5) Ceiling: 24 inch x 24 inch x 5/8 inch acoustical ceiling tile (model #- USG Fissured 560) with USG grid main tee (model # DXL24), cross tee (model # DXL 216), wall angle (model # M7), wind clips and other components as manufactured by USG, or equal.

6) Roof Hatch:

(a) Provide roof hatch as indicated on the drawings and specified in Division 7 Section "Roof Accessories".

(b) Provide alternating tread stairs and platforms where indicated. Fabricate of open type construction with structural steel pipe stringers, pipe handrails, and cast or stamped steel plate cantilevered treads and gratings, unless otherwise indicated. Provide all necessary brackets and fittings for installation. Galvanize all steel construction. Manufacturer/Product: Subject to compliance with requirements, manufacturer's products shall be Lapeyre Stair/56 degree steel stair and platform assemblies as indicated on the Drawings.

(c) Handrails and Guardrails: Provide handrails and guardrails as indicated on the drawings and specified in Division 5 Section "Pipe and Tube Railings".

d. Exterior Doors:

1) Full flush steel construction with honeycomb core. 18 gauge skin sheets. Dimensions: 3 feet 0 inches x 6 feet 8 inches. Color: White.

2) Steel doorframe (16 gauge) complete with ½- inch threshold and weather-stripping.

3) Exterior Hardware: Yale 546F Exterior Trim, or equal. Handles shall be lever- type that allows operation without tight grasping or twisting of the wrist. Keyed alike locks.

4) Interior Hardware: Yale 2100 Exit Device, or equal. Handle shall be panic bar that allows for opening without any grasping, twisting or turning.

e. Interior Doors:

1) Interior Birch Unit. Dimensions: 3 feet 0 inches x 6 feet 8 inches.

2) Hardware: Handles shall be lever type that allows operation without tight grasping or twisting of the wrist.

f. Interior Walls:

1) Framing to be steel galvanized studs (25 gage) 1 1/4 inch x 3 5/8 inch at maximum 2 feet on center.

2) Finishes to be consistent with all other interior finishes.

3) Fixed glass windows (2’0” by 4’8”) shall be located at front of interior walls above counter to allow for better viewing.

g. Exterior Windows:

1) Frame: Extruded aluminum single hung, vertical sliding unit, thermal break.

2) Sash: Tilt toward inside for easy cleaning.

3) Glazing: Clear tempered panes.

4) Dimensions of each unit: Dependent on compartment size. At interior wall locations or structural support locations the dimension between windows shall be no greater than 6 inches.

5) Finish: Electro-statically applied acrylic enamel.

h. Work Bench

1) 24 inch wide workbench constructed of 4 inch x 2 1/2 inch x 14 gauge steel, and 3/4" wood. Countertop heights shall be constructed to allow wheelchair usage at all locations.

2) Plastic laminate top: Equal to Wilson art Laminates. Finish: 2904-60 White Suede. Thickness: 050 (12 mm nominal)

3) Glue: 3M Green Contact Adhesive, or equal.

i. Painting: Materials equal to products specified under Division 9 painting sections.

1) Surfaces: Exterior Doors, Door Frames

(a) Primer: Applied by Door Manufacturer.

(b) Finish: 2 coats acrylic latex semi-gloss enamel applied by press box manufacturer.

2) Surfaces: Interior Doors

(a) Primer: Jones Blair Interior Exterior Oil Primer, or equal.

(b) Finish: 2 coats acrylic latex semi-gloss enamel.

3) Surfaces: Exterior Siding

(a) Primer: Applied by Siding Manufacturer.

(b) Finish: Applied by Siding Manufacturer.

(c) Touchup: If applicable

j. Surfaces: Wall and Roof Structure.

1) Primer: Direct-to-metal industrial acrylic metal primer applied after welding, or equal.

k. Caulking: Polyurethane sealant, all temperature, UV resistant; silicone products are not acceptable.

l. Electrical:

1) Submittal drawing shall indicate devices and circuitry.

2) Fixtures: 2-lamp, 40 watt fluorescent, white strip design as manufactured by Lithonia Lighting, or equal. Fixtures shall be located above countertop and be maximized to full length of compartment space.

3) Wiring to be in non-metallic panduit, or equal. N.E.C. breaker box to be 100- amp surface mounted on wall with 2-inch rigid conduit to be stubbed out at back wall of press box ready for service line to be connected.

4) Electrical outlets installed per NEC shall be standard duty. All outlets shall be surface mounted on wall.

5) Sound, Telephone, Clock, Field Communication: Empty double outlet boxes per N.E.C. with 3/4 inch conduit stubbed out bottom of Press Box for use of Owner. Outlet boxes to be flush mounted into wall. Any wiring completed on-site will be responsibility of such contractor for inspections. Quantity. Two will be provided. Owner shall indicate additional boxes needed.

6) Filming Gallery: Weather-tight outlet box for cameras. Quantity: Three. Owner shall indicate additional outlets needed.

7) Provide baseboard heater only.

2.04 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.

2.05 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: non-specular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

2.06 GALVANIZED STEEL FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Surface Preparation: Clean surfaces with non-petroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

1. Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds in steel, complying with SSPC-Paint 20.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for, installation tolerances, and other conditions affecting performance of Work.

B. Verify with Owner's testing company that foundation bearing conditions are in accordance with assumptions made in design calculations and shop drawings.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 ERECTION

A. Install pre-engineered grandstands and bleachers in accordance with manufacturer's instructions and final shop drawings. Provide accessories indicated or required and anchors, inserts and other items required for installation of units and attachment of adjoining construction.

B. Set press box plumb and aligned. Level base plates true to plane.

3.03 FIELD QUALITY CONTROL

A. Arrange for grandstands, bleachers, and press box manufacturer's technical personnel to inspect grandstands, bleachers, and press box and components during installation and at final completion and to

certify compliance with requirements.

B. Notify Architect 48 hours in advance of date and time of final inspection.

C. Obtain Use and Occupancy Inspection from local authority having jurisdiction.

3.04 ADJUSTING AND CLEANING

A. Adjust doors, operable windows, and hardware to operate smoothly, easily, properly, and without binding. Confirm that locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

C. Clean installed grandstand and bleacher units on exposed and semi-exposed surfaces. Touch-up shop applied finishes to restore damaged or soiled areas.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Anodes and attachment to buried metallic components including buried tanks.

1.02 RELATED REQUIREMENTS

A. Section 26 0533.13 - Conduit for Electrical Systems.

B. Section 31 2316 - Excavation.

C. Section 31 2316.13 - Trenching.

D. Section 31 2323 - Fill.

1.03 REFERENCE STANDARDS

A. ASTM B418 - Standard Specification for Cast and Wrought Galvanic Zinc Anodes 2016a.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2014.

C. NACE SP0169 - Control of External Corrosion on Underground or Submerged Metallic Piping Systems 2013.

D. NACE SP0177 - Mitigation of Alternating Current and Lightning Effects on Metallic Structures and Corrosion Control Systems 2014.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate wiring diagrams.

C. Product Data: Provide data for anodes and test panels.

D. Manufacturer's Installation Instructions: Include procedures applicable to protecting differing metals.

E. Designer's Qualification Statement.

F. Installer's Qualification Statement.

G. Project Record Documents: Accurately record actual locations of anodes and test panels.

H. Operation Data: Include periodic test procedures.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in Maryland.

B. Installer Qualifications: Company specializing in performing the work of this Section with minimum three years experience.

C. Products: Listed, classified, and labeled as suitable for the purpose intended.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 CATHODIC PROTECTION

A. Provide a design that complies with recommendations of NACE SP0169 and NACE SP0177.

2.02 MATERIALS

A. Magnesium Anodes: Core of galvanized steel, tape, bare weight of 9 lbs (4 kg), coating alloy content complying with the following:
   1. Aluminum: 0.05 percent, maximum.
   2. Manganese: 0.5 to 1.3 percent, maximum.
   3. Zinc: 0 percent, maximum.
   4. Silicon: 0 percent, maximum.
   5. Copper: 0.02 percent, maximum.
   6. Nickel: 0.001 percent, maximum.
   7. Iron: 0.03 percent, maximum.
   8. Other Impurities: 0.3 percent, maximum.

B. Zinc Anodes: ASTM B418 Type II, cast galvanic zinc, tape, bare weight of 5 lbs (2.3 kg).

C. Anode Lead Wire: Solid copper conductor, 12 AWG, Type TW insulation.

D. Field Wiring: Stranded copper conductor, AWG Type TW insulation.

E. Conduit: Rigid galvanized steel.

F. Backfill at Anodes: Blended granular mixture, 100 percent passing a #10 (150 micro m) sieve mesh screen; composed of the following:
   1. Hydrated Gypsum: 75 percent.
   2. Bentonite Clay: 20 percent.
   3. Sodium Sulphate: 5 percent.

G. Test Boxes: Precast concrete, of sulphate resisting Portland cement concrete.
   1. Concrete cover, with "Cathodic Protection Test" identification markings in letters not less than 1.5 inches (38 mm) high.
   2. Enclosure: NEMA 250 Type 3.
   3. Terminal Board: One piece with screw terminals rated 15 amperes.
   4. Shunt: 0.01 ohm, 6 ampere, accuracy of plus or minus 1 percent.
   5. Current Control Resistor: adjustable slide wire type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify buried pipe systems are completed and tested.

3.02 INSTALLATION

A. Fasten anode lead wire to anode tape by silver brazing. Provide wire length of 10 feet (3 m). Insulate connection to 600 volts, overlapping lead wire insulation by 1/2 inch (12 mm) minimum.

B. Pack anode and backfill in cloth bag; center anode and firmly pack backfill with mechanical vibrator. Use backfill material of a packaged weight 2.5 times the unit weight of the anode.

C. Provide bonding to ensure protected components are electrically continuous.

D. Connect system to ferrous pipe by exothermic weld methods.

E. Locate test stations as follows:

1. At each location of protected pipe crossing another metallic pipe.
2. At each end of casing under roadway.
3. At each inaccessible insulating pipe joint.
4. At intervals not to exceed 1,000 feet (330 m).

F. Restore corrosion protective coatings and wraps damaged during installation.

G. Coordinate this work with placement of buried site metallic components requiring protection.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's reports with submittals.

C. Comply with NACE SP0169 and NACE SP0177.

END OF SECTION

PART 1 - GENERAL

1.01 GENERAL

A. Comply with Bidding and Contract Requirements, Division 1 - General Requirements.

1.02 SCOPE

A. Provide elevator renovations as indicated on Statement of Work provided as part of RFP package.

B. Existing Conditions and Building Equipment: Provide new equipment to fit within existing spaces, structural conditions and building constraints. Provide new equipment compatible with retained elevator equipment and existing building systems. Unless noted otherwise, retain existing functions and features.

1.03 QUALITY ASSURANCE

A. Regulatory Requirements: Elevator Contractor is responsible for modifications to the elevator equipment that are required by regulatory authorities as a result of alterations described in this specification. Perform all work in compliance with applicable regulatory requirements of the laws, codes, ordinances, and regulations of Federal, State, and Municipal authorities having jurisdiction.

B. Permits, Inspections and Certifications: Coordinate, obtain and pay for all required inspections, elevator permits, building permits, temporary permits and consultations necessary to complete the work described in this specification.

1.04 SUBMITTALS

A. Refer to General Specifications for requirements.

1.05 WARRANTY

A. Refer to General Specifications for requirements.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS AND INSTALLERS

A. Products requiring proprietary service will not be acceptable.

2.02 RETAINED EQUIPMENT

A. Reconditioning: All retained equipment is to be reconditioned and refurbished to operate properly, safely and reliably, in accordance with these specifications, or if not specified herein, with original manufacturer specifications. Reconditioning may include, but is not limited to, inspection, testing, cleaning, lubricating, repair, rebuilding, re-insulating, balancing, painting and/ or adjusting. Replace worn, damaged or malfunctioning components. Fastenings and hardware are to be checked, properly tightened, and replaced as required. If a component cannot be reconditioned or refurbished, component is to be replaced with new.

B. Additional Modifications: Elevator Contractor is responsible for any additional modifications to the elevator equipment to conform with regulatory requirements in effect during the performance of this work, and required due to alterations described in this specification.

C. Completion of Work: Complete all required refurbishment and maintenance repairs to retained equipment while elevators are out of service for modernization. Provide a check list for each elevator, indicating completion of this work for each major retained component, prior to final completion of each elevator. Submit check list to Owner for review and approval.

2.03 SYSTEM OPERATING FEATURES

A. Duty: The present capacity, pounds and speed will be retained, unless otherwise noted.

B. Travel: The present travel will be retained, unless otherwise noted.

C. Stops and Openings: The present openings will be retained, unless otherwise noted.

D. Automatic Self-Leveling: The elevator shall be provided with automatic self-leveling that shall typically bring the elevator car level with the floor landings + ¼" regardless of load or direction of travel.

E. Firefighter's Emergency Operation (FEO): Applicable only if existing unit has fire service.

1. Special Emergency Service operation shall be provided in compliance with the latest applicable revision of the ASME/ANSI A17.1 Code.

2. Firefighters' Emergency Operation Phase I to return the elevator(s) non-stop to a designated floor shall be initiated by an elevator smoke detector system or a key switch provided in a lobby fixture.

3. Smoke detector system to be provided by Contractor. Contractor shall provide contacts on the elevator controller to receive signals from the smoke detector system and all associated devices.

4. A FEO cabinet shall be installed in the Car Operating Panel with a key switch for in-car control of each elevator during Phase II of FEO.

5. If an elevator is on independent service when the elevator(s) are recalled on Phase I operation, a buzzer shall sound in the car and a jewel shall be illuminated, subject to applicable codes.

2.04 MACHINE ROOM EQUIPMENT

A. Controller (NEW): a microprocessor-based control system shall be provided to perform all the functions of safe elevator motion and elevator door control. This shall include all the hardware required to connect, transfer and interrupt power, and protect the motor against overloading. The system shall also perform group operational control. Each controller cabinet containing memory equipment shall be properly shielded from line pollution. The microcomputer system shall be designed to accept reprogramming with minimum system downtime.

B. Operation - ONE CAR: Operation shall be automatic by means of the car and landing buttons. Stops registered by momentary actuation of the car or landing buttons shall be made in the order in which the landings are reached in each direction of travel after the buttons have been actuated. All stops shall be subject to the respective car or landing button being actuated sufficiently in advance of the arrival of the car at that landing to enable the stop to be made. The direction of travel for an idle car shall be established by the first car or landing button actuated. "UP" landing calls shall be answered while the car is traveling in the up direction and "DOWN" landing calls shall be answered while the car is traveling down. The car shall reverse after the uppermost or lowermost car or landing call has been answered, then proceed to answer car calls and landing calls registered in the opposite direction of travel. If the car without registered calls arrives at a floor where both up and down hall calls are registered, it shall initially respond to the hall call in the direction that the car was traveling. If no car call or hall call is registered for further travel in that direction, the car shall close its doors and immediately reopen them in response to the hall call in the opposite directions. Direction lanterns, if furnished, shall indicate the change of direction when the doors reopen.

1. An independent service switch shall be provided in the car operating panel which, when actuated, shall cancel previously registered car calls, disconnect the elevator from the hall buttons and allow operation from the car buttons only.

C. Power Supply (RETAINED, IF SUFFICIENT. REPLACE IF REQUIRED): the present power supply will be retained and the new equipment will be arranged for this power supply.

D. Soft Starter (NEW): A new solid-state starter will be provided. It will be of the same power requirement and starting configuration as presently exists.

E. Motor (REPLACED): The existing motor will be replaced with a motor that is of the same power characteristics and starting configuration as presently exists.

F. Power Unit (NEW): The existing power unit will be replaced with a new power unit. The new power unit consists of a pump, motor, integral control valve, oil tank and muffler. The pump and motor are submerged and are mounted to the tank with rubber isolators to reduce vibration and noise. The pump and motor are externally mounted and are belt driven. A muffler is provided to dissipate pulsations and noise from the flow of hydraulic fluid. The valve consists of up, up leveling, down and down leveling controls along with manual lowering and a pressure relief valve.

G. Valve (NEW): A new integral control valve will be installed to replace the existing valve. The valve consists of up, up leveling, down and down leveling controls along with manual lowering and a pressure relief valve.

2.05 DOOR EQUIPMENT

A. Closed Loop Door Operator (NEW) Install a new closed loop door operator. Car and hoist way doors shall be power operated by means of a closed loop door operator mounted on top of the car designed to give consistent door performance with changes in temperature, wind or minor obstruction in the door track. The system continually monitors door speed and position and adjusts it accordingly to match the pre-determined profile.

B. Door-Protection Device (NEW): Install a new solid state, infrared passenger protection device on the car door. Elevator doors shall be provided with a reopening device that will stop and reopen the car door(s) and hoistway door(s) automatically should the door(s) become obstructed by an object or person. Door protection shall consist of a two dimensional, multi-beam array projecting across the car door opening.

C. Interlocks (NEW) New interlocks will be installed. The interlocks shall prevent operation of the elevator unless all doors for that elevator are closed and shall maintain the doors in their closed position while the elevator is away from the landing. Emergency access to the hoistway as required by governing codes shall be provided.

D. Car Door Hanger (RETAINED): Existing car door hanger will be retained and inspected for proper alignment. Adjust as required.

2.06 HOISTWAY EQUIPMENT

A. Hoistway Operating Devices (NEW): Normal terminal stopping devices shall be provided to slow down and stop the car automatically at the terminal landings and to automatically cut off the power and apply the brake, should the car travel beyond the terminal landings.

B. Car Guides (RETAINED): The existing car guides shall be retained. They shall be thoroughly inspected. Any worn parts will be replaced by the original manufacture parts or equal.

C. Car Frame (RETAINED): The existing car frame shall be retained.

D. Platform (RETAINED): The current platform will be retained.

E. Hoistway Entrances (RETAINED): The present hoistway entrances will be retained.

F. Pit Switch (NEW): An emergency stop switch shall be located in the pit accessible from the pit access door.

G. Spring Buffers (NEW): Spring buffers shall be installed in the pit as means for stopping the car at the bottom limits of travel, consistent with code requirements.

H. Exterior Door Frame & Door Skins (RETAINED): Existing to be retained and polished to like new condition.

I. Hoistway Door Hanger (NEW) The present hoistway door hanger will be replaced with a new hoistway door hanger.

2.07 PISTON AND CYLINDER REPLACEMENT (NEW, UNLESS NOTED OTHERWISE)

A. Cylinder: The cylinder shall be of a double bottom design constructed of steel pipe of sufficient thickness and suitable for the operating pressure as prescribed by the latest revision of the ASME A17.1 or CAN3-B44 codes. The top of the cylinder shall be equipped with a new cylinder head with a drip ring to collect any oil seepage as well as an internal guide ring and self-adjusting packing. The cylinder exterior shall be covered with a protective coating. Sealed PVC Protection helps protect the cylinder from corrosion, permits monitoring and evacuation of liquids to make sure the cylinder does not come in contact with water, and helps contain oil should the cylinder leak. The sealed PVC Protection can help protect your property against possible environmental contamination and clean-up.

B. Plunger: The plunger shall be constructed of selected steel tubing or pipe of proper diameter machined true and smooth with a fine polished finish. The plunger shall be provided with a stop ring electrically welded to it to prevent the plunger from leaving the cylinder.

C. Cylinder Head Support: Remove the existing cylinder-head support for cylinder replacement. After installation of the cylinder and sealed PVC Protection System is complete, provide a new cylinder-head support. Remove the existing cylinder from the original well hole.

D. Hole-less Pit: Existing pit locations which contain a well hole are to be converted to “hole-less.”

2.08 FIXTURES AND AESTHETICS

A. Car Operating Panel (NEW): Provide a new applied (or integral) car operating panel containing all push buttons, key switches, and message indicators for elevator operation. The car operating panel shall have a satin stainless steel finish. It shall contain a bank of round satin stainless steel, LED illuminated mechanical buttons. Flush mounted to the panel and marked to correspond to the landings served. All buttons to have raised numerals and Braille markings. The car operating panel shall be equipped with the following features:

1. Raised markings and Braille to the left hand side of each push-button.
2. Car Position Indicator at the top of and integral to the car operating panel.
3. Door open and door close buttons.
4. Inspection key switch.
5. Help Button/Hands-Free phone: The help button shall initiate two-way communication between the car and a location inside the building, switching over to another location if the call is unanswered, where personnel are available who can take the appropriate action. Visual indicators are provided for call initiation and call acknowledgement.
6. Landing Passing Signal: A chime bell shall sound in the car to signal that the car is either stopping at or passing a floor served by the elevator.

B. Hall Buttons (NEW): Provide new stainless steel/ bronze hall buttons or key switches and faceplates at each landing, with an up button and a down button at each intermediate landing and a single button at each terminal landing. Faceplates shall be surface mounted to wall.

1. A call shall be registered by momentary pressure of a landing button. The button shall become illuminated and remain illuminated until the call is answered. All buttons, when applicable, to be long life LED illumination.

C. In-Car Lantern and Chime (NEW): Install in the car entrance, a new car lantern with chime indicating directional lantern visible from the corridor. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel and a chime will sound.

D. Cab Interiors (NEW): Cab interiors renovation shall include the following:

1. New cab interior panels: The existing elevators shall have the (existing panels removed, interior walls prepared) to accommodate the Interiors Package. This shall include a modular horizontal panel system that spans the full width of the wall sections. Plastic Laminate reveals shall be installed in the corners and against the return and strike jamb portions of the interior. Panels shall be finished in plastic laminate as selected from our standard laminate selections. The base shall be finished in plastic laminate. (We shall furnish a one-eighth inch satin stainless steel inlay in the horizontal reveals between each panel.)
2. Handrail: New satin stainless steel handrails shall be mounted to the new interior panels on the (rear wall in accordance with ADA requirements and local governing codes.
3. Ceiling: Provide a new ceiling assembly. The existing lighting shall be modified and new incandescent down lights shall be installed. The ceiling shall be panel construction finished in metal look-alike laminate.
4. Emergency Car Lighting: An emergency power unit employing a 12-volt sealed rechargeable battery and a totally static circuit shall be provided. The power unit shall illuminate the elevator car and provide current to the alarm bell in the event of normal power failure. The equipment shall comply with the requirements of the latest revision of the ASME/ANSI A17.1 Code.

E. Car Enclosure (RETAINED): The present car enclosure shall be retained.

2.09 ADDITIONAL REQUIREMENTS

A. Work is expected to be delivered turn-key ready. The following items shall be included by Contractor;

1. Air Conditioning - Provide suitable ventilation and cooling equipment, if required, to maintain the machine-room temperature between 45oF and 95o.
2. Building Power - Provide electrical power for light, tools, hoists, etc. during installation as well as electric current for starting, testing and adjusting the elevator. Power of permanent characteristics to be provided to properly operate all of the elevators concurrently scheduled to be modernized. Power must be a 3-phase 4 wire system with ground and bonded disconnects. Grounded leg delta systems are not acceptable.
3. Smoke & Heat System - Provide a smoke and heat detector system, located as required with wiring from the sensing devices to each elevator controller.
4. Sprinklers - Provide code compliant sprinkler system, as required, in the hoist way, pit and machine room.
5. Cutting & Patching - Do any cutting, (including cutouts to accommodate hall signal fixtures, entrances and/or machine room access) patching and painting of walls, floors or partition.
6. Main Disconnect - Provide a fused lockable disconnect switch or circuit breaker for each elevator per the National Electrical Code with feeder or branch wiring to the transformer. Size to suit elevator contractor. Provide a SHUNT TRIP disconnect, as required, if sprinklers are being provided. Provide suitable connections from the main disconnect to the elevator control equipment.
7. Ground Wire - Provide a properly sized ground wire from the elevator controller(s) to the primary building ground.
8. Car Light Power Supply & Disconnect - Provide a 120 volt AC, 15 amp, single-phase power supply with fused SPST disconnect switch for each elevator, with feeder wiring to each controller for car lights.
9. Lighting - Any modification or installation of lights and/or GFI electrical outlets in the machine room, secondary level and/or pit to be performed by others. Provide sufficient lighting in the buildings

common areas to facilitate a safe working environment.

10. Machine Room Access - Provide a self-locking and self-closing door for the elevator machine room. Access door to be adequately sized to accept our equipment. Modify machine room access, as required, to comply with code and facilitate safe egress of all equipment.
11. Fire Extinguisher - Provide fire extinguisher in elevator machine room.
12. Non-Elevator Material in Hoistway - Remove or encapsulate, as required, any non-elevator related pipes or wiring located in the elevator machine room or hoist way.
13. Hoistway Ventilation - Provide code compliant hoist way ventilation. Code requires a means to prevent the accumulation of hot air and gasses at the top of the hoist way. Pressurizing the hoist ways, or providing vents from the top of the hoist way to the outside of the building usually accomplishes this. Vents shall not be less than 3 1/2% of the area of the hoist way or less than 3 sq. ft. for each elevator car, whichever is greater. You may not vent the hoist way to the machine room. If the hoist way vents must run through the machine room, they must be enclosed in a fire rated structure and not violate clearances around our equipment.
14. Hoistway Ledges - Provide a 75-degree angle constructed of a non-combustible material on all ledges that are 2” are greater in the hoist way, excluding multi-hatch divider beams.
15. Side Counterweight Guarding - Provide and install guarding of counterweights in a multiple elevator hoist way as required, when a counterweight is located between elevators, the counterweight runway shall be guarded on the side next to the adjacent elevator. The guarding must meet or exceed the requirements of ASME A17.1 – 2007, section 2.3.2.3.
16. Pit Ladders - Provide a pit ladder, as required, in each pit that does not have walk in access doors. Ladder shall extend 48” above first landing access door.

2.10 GENERAL REQUIREMENTS

A. Wiring: All wiring and electrical interconnections shall comply with governing codes. Insulated wiring shall have flame retardant and moisture-proof outer covering and shall be run in conduit, tubing or electrical wire ways. Traveling cables shall be flexible and suitably suspended to relieve strain on individual conductors.

B. Superseded Material: All material, removed or unused, not required in the modification will become the property of the contractor and we reserve the right to remove and retain it. PGCPS holds first right to claim existing items and equipment being replaced.

C. Permits and Inspections: Contractor shall furnish all licenses and permits and shall arrange for and make all required inspections and tests including third party.

D. Code: The elevator equipment shall be furnished and installed in accordance with the applicable version of the ASME/ANSI A17.1/ CS-B44 Safety Code for Elevators and Escalators, An American National Standard, including the latest Supplement, and the Americans with Disabilities Act.

PART 3 - EXECUTION

3.01 PREPARATION

A. Verification of Conditions: Examine areas to receive Work and conditions under which Work would be performed. Remedy conditions detrimental to the proper and timely completion of the Work Do not proceed until unsatisfactory conditions have been corrected.

B. Verification of Conditions: Examine areas to receive Work and conditions under which Work would be performed. Remedy conditions detrimental to the proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

C. Field Measurements: Existing equipment data included in these specifications is provided for Contractor's convenience only. Contractor is responsible to field verify equipment type, capacity, speed, floors served, arrangement, features, dimensions, conditions and other relevant characteristics before proceeding with Work, and to obtain field measurements and data for related building systems associated with elevators required for proper completion of this work.

3.02 INSTALLATION

A. Installation: By manufacturer, per requirements of governing agencies.

B. Housekeeping: Contractor is to maintain neat working conditions at all times and to promptly dean up any dust, or debris due to Elevator Contractor's work. Contractor to provide necessary tarps, plastic or paper to protect floors and walls from soiling, staining or damage.

C. Removal of Existing Equipment and Retaining Spare Parts: Owner will direct Contractor which replaced existing components are to be retained as spare parts for use on Owner's other projects. Other removed parts become the property of Contractor, and are to be disposed of by Contractor, including dumpster costs as needed.

D. Environmental Requirements and Disposal of Material: Elevator Contractor to comply -with all applicable environmental and safety regulatory requirements. Contractor to properly dispose of removed equipment and any hazardous material according to applicable regulatory requirements and environmentally sound practices.

3.03 WORKMANSHIP

A. General: Finished work strong, rigid, neat in appearance and free from defects. Make plain surfaces smooth and free from warps and buckles; apply molded members straight and true; make connections between various members right to eliminate possible vibrations.

3.04 FIELD QUALITY CONTROL

A. Operations: Demonstrate to Owner that all automatic and special operations comply with Contract Documents.

B. Correction: Replace or remedy defects and discrepancies are no cost to Owner.

C. Instruction: Instruct Owner's personnel in proper use and operation of the elevator systems provide manuals, instructions and definitions for systems provided.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. A vertical platform (wheelchair) lifting device, designed to provide access to or within a building for mobility impaired persons. Lift consists of machine tower and lifting platform selected and dimensioned to provide adequate lifting height to suit building access requirements indoors and out.

1.02 REFERENCES

A. Lift shall be designed, manufactured and installed in accordance with the following standards:

1. American National Standards Institute (ANSI).
2. American Society of Mechanical Engineers (ASME).
3. ADA Accessibility Guidelines (ADAAG).
4. Underwriters Laboratories (UL).
5. International Building Code (IBC).
6. National Electrical Code (NEC).
7. American Society for Testing Materials (ASTM).
8. American Welding Society (AWS).

1.03 SYSTEM DESCRIPTION

A. Drive:

1. AC powered ballscrew drive; 1/2 hp, 120 V, 60Hz, instant reversing motor.

B. Number of Stops: 2 stops.

C. Platform Configurations: straight-thru and enter/exit same side.

D. Maximum Travel: Varies for each unit, refer to drawings.

E. Rated Load: 750 lbs. with minimum safety factor of 5X.

F. Rated Speed: 9-12 fpm (ballscrew drive) with rated load.

G. Platform Size: 36"x60"with 42" high guard panels.

H. Main Power Supply Wiring: Electrical contractor shall provide 115VAC, single phase, 20 amp, 60 Hz power circuit.

I. Operating Features:

1. Platform Controls: Directional paddle switch, on/off key switch, emergency stop switch with alarm and illuminated alarm button.
2. Landing Controls: Directional paddle switch and on/off key switch, emergency stop switch with alarm, mounted inside gate/door frames.
3. Constant pressure operation.
4. Grounded electrical system with upper, lower and final limit switches and 24 V operating controls.
5. Platform underpanel equipped with obstruction sensors.
6. Ramp with incline of 1:12.
7. Non-slip surface on platform floor and ramp.

8. Grab rail on platform.
9. Manual lowering device.
10. Integral ballscrew safety device and electromechanical brake (ballscrew drive).
11. Pit switch.
12. Upper Landing Gate/Door:
    a. 42" high, self-closing gate with VDR™ mechanical interlock and steel sheet insert panel.
    b. 6'-8" self closing, flush mount, 1-1/2 hour fire rated door with VDR™ mechanical interlock and 3"x26" glass vision panel.
13. Lower/Middle Landing Door:
    a. 6'-8" self closing, flush mount, 1-1/2 hour fire rated door with VDR™ mechanical interlock and 3"x26" glass vision panel.

1.04 QUALITY ASSURANCE

A. Manufacturer: Provide wheelchair lift manufactured by a firm with a minimum of 25 years experience in fabrication of wheelchair lifts equivalent to those specified.

B. All designs, clearances, workmanship and material, unless specifically excepted, shall be in accordance with all codes having legal jurisdiction.

C. All load ratings and safety factors shall meet or exceed those specified by all governing agencies with jurisdiction and shall be certified by a professional engineer.

D. Lift shall be subject to applicable state, local and city approval prior to installation and subject to inspection after installation. Determination of and adherence to these regulations is the responsibility of the lift contractor.

E. Welders certified in accordance with requirements of AWS D1.1 shall perform all welding of all parts.

1.05 WARRANTY

A. Manufacturer shall warrant the vertical platform lift’s drive system for a period of two years after installation and all other components for one year after installation.

B. Extended Warranty: Manufacturer shall warrant the vertical platform lift for a period of 5 years after installation with the purchase of a preventative maintenance program from lift contractor for an equal number of years.

1.06 MAINTENANCE

A. The vertical platform lift must be maintained in accordance with manufacturer’s instructions.

PART 2 - PRODUCT

2.01 MANUFACTURER

A. Basis-of-Design: Inclinator vertical platform lift Model VL manufactured by Inclinator Comany of America.

B. Other Acceptable Manufacurers:
    1. Garaventa.
    2. Symmetry Elevating Solutions.

2.02 MATERIAL

A. Machine Tower: 14 ga. steel sheet.

B. Guide Rail: 3" x 2" x 1/8" ASTM A500 grade B steel tubing.

C. Base Frame: 2" x 2" x 1/4" structural steel tubing and angle.

D. Lift Weldment: 3/8" hot rolled steel plate and 2" x 2" x 1/4" wall structural steel tubing.

E. Side Guard Panels: 18 ga. galvanealed steel sheet in 1" x 2" x 14 ga. steel tubing frame.

F. Front Access Panel: 20 ga. galvanealed steel sheet.

G. Platform: 11 ga. steel plate.

H. Access Ramp: 11 ga. steel plate.

2.03 FINISHES

A. Components shall be prepared with 1)alkaline detergent wash, 2) clear water rinse, 3)iron phosphate coating, 4)clear water rinse and finished with electrostatically applied and baked thermostatic powder coat finish for indoor or outdoor use.

B. Color: As selected from manufacturers standard colors.

2.04 ELECTRICAL SYSTEMS

A. The electrical contractors shall provide a 115V, single phase, 20 amp, 60 Hz electrical power source connection.

B. Electrical piping and wiring supplied by others.

C. Final electrical connections performed by lift contractor.

PART 3 EXECUTION

3.01 ACCEPTABLE INSTALLERS

A. Installers shall be experienced in performing work of this section who have specialized in work comparable to that required for this project.

B. Installers shall be certified and trained by the manufacturer.

3.02 EXAMINATION

A. Use field dimensions and approved manufacturer’s shop drawings to examine substrates, supports and other conditions under which this work is to be performed. Do not proceed with work until unsatisfactory conditions are corrected.

3.03 INSTALLATION

A. Vertical platform lift shall be installed in accordance with manufacturer’s instructions and as specified and approved by architect.

B. Landing gates and doors shall be installed by others. Electrical piping and wiring by others. Final electrical connections and lift adjustments by lift contractor.

3.04 DEMONSTRATION

A. The lift contractor shall make a final check of the lift’s operation with the Owner or Owner’s representative present prior to turning the lift over for use. The lift contractor shall determine that operating and safety devices are functioning properly.

END OF SECTION

Part 1 - General

I. General

A. The Bidding and Contract Requirements, Division 1 -General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods shall apply to this section.

II. Scope

A. An automatic sprinkler system shall be designed, installed, tested and approved for the entire building in accordance with Fairfax County School standards, NFPA standards, state codes, local jurisdiction's requirements and contract documents.

B. In all renovation and addition projects the contractor shall provide temporary protection for all branch mains and bulk mains run through corridors where the ceiling has been removed. The contractor shall provide upright sprinklers (within 12" of the deck above) along the path of all water charged sprinkler branch mains and bulk mains in the corridor. When the ceilings are replaced the upright sprinklers shall be removed and the outlets they were connected to shall be capped.

III. Quality Assurance

A. The automatic sprinkler system shall be tested in accordance with NFPA No. 13, FM 1637, UL 2443 and be approved by the local jurisdiction.

B. The sprinkler contractor shall be licensed by the local jurisdiction to install the sprinkler system as required.

C. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

1. All castings used for coupling housings, fittings, and valve bodies shall be date stamped for quality assurance and traceability.

IV. Submittals

A. This contractor shall prepare eight sets of shop drawings for the Architect to review. The local jurisdiction, the Architect and the Owner shall approve the shop drawings. The shop drawings shall include detailed working drawings at a scale no smaller than 1/8" per foot and shall also include lighting fixtures, ductwork, ceiling diffusers, grilles, HVAC and plumbing piping and any other possible obstructions. An overall plan showing the sprinkler zones shall be included on the working drawings (See paragraph 2.05). Calculations, sprinkler heads, alarm check valve, flow switches and other equipment shall

also be included on the shop drawings. No sprinkler piping shall be installed until shop drawings have been reviewed.

Part 2 - Products

I. Design

A. The entire building shall receive a sprinkler system, hydraulically designed and zoned. Zones shall not exceed fifty thousand square feet (50,000 sq. ft.). The sprinkler design shall be a wet-pipe system for the interior of the building. Attic spaces, crawlspaces and areas subject to freezing shall receive dry system. Loading docks, Walk-in freezer and unheated outdoor storage shall have dry heads. The sprinkler contractor shall obtain current hydrant flow test information from the local water authority prior to starting any design work.

II. Sprinkler Heads

A. Sprinklers shall be glass bulb type, with hex-shaped wrench boss integrally cast into the sprinkler body to reduce the risk of damage during installation. Wrenches shall be provided by the sprinkler manufacturer that directly engage the wrench boss. Sprinklers with rubber O-Rings are not acceptable. Acceptable manufacturers include:

1. Victaulic
2. Viking
3. Reliable Automatic Sprinkler Corporation of America
4. Tyco

B. Sprinkler heads, where there are ceilings, shall be recessed mounted with a polished chrome finish and escutcheon and shall be quick response type. Heads shall be as manufactured by Victaulic model "V2708". Exception: Sprinkler heads in locker rooms and shower rooms shall have a corrosion resistant coating.

C. Sprinkler heads, upright or pendent, exposed, shall be factory brass and shall be quick response as manufactured by Victaulic model "V2704 (upright) and V2708 (pendant)".

D. Sprinkler heads, dry sidewall, shall be glass bulb, quick response with white epoxy coating and escutcheon as manufactured by Victaulic model "V3610".

E. Sprinkler heads, sidewall, shall be wall mounted with polished chrome finish and escutcheon and shall be extended coverage quick response as manufactured by Victaulic model "V3416".

F. Sprinkler heads, dry pendant, shall be extended type glass bulb, quick response with corrosion resistant coating and escutcheon as manufactured by Victaulic model "V3606".

Provide and install dry sprinkler boot as manufactured by Victaulic to eliminate the air gap at the wall or ceiling.

G. Sprinkler heads in unoccupied spaces may be rough brass.

H. Sprinkler heads, concealed, shall have factory finished white painted cover plate and shall be quick response as manufactured by Victaulic model "V3904". For ceilings painted black, custom black painted cover plate shall be provided.

I. Provide sprinkler guards on all heads in the physical education rooms, gymnasiums, gym storage, walk-in coolers, loading docks, all storage rooms, gang toilets, locker rooms, boiler rooms and in mechanical rooms. Guards in occupied spaces shall be chrome plated. See 3.01.R for gang toilet and locker room exception.

J. Escutcheons and guards shall be listed, supplied, and approved for use with the sprinkler by the sprinkler manufacturer.

K. Sprinkler heads shall be of the same manufacturer for each type used.

L. Escutcheon finishes shall match that of the sprinkler head they serve.

M. Chrome plating is not an acceptable corrosion resistant coating.

III. Flow Switches

A. The flow switches shall be vane type. The flow switches shall be equipped with two sets of form 'C' contacts. Flow switches as manufactured by Potter Electric or Viking shall be acceptable.

IV. Chrome Fire Department Connection (siamese)

A. Two-way projecting Siamese with cast brass, straight Y pattern, double inlet body, furnished with plugs and chains, and brass escutcheon plate lettered 'AUTO. SPKR.' Finish - polished brass chrome plated and shall be manufactured by Potter Roemer, No. 5750 with automatic ball drip. Provide low point drain for service. Siamese connections fully equal to the item specified, manufactured by ELKHART, GUARDIAN FIRE EQUIPMENT< FIRE END< CROKER CORPORATION or POWHATTAN shall be acceptable. Siamese connections with a rough brass finish are not allowed. Provide a minimum 24" x 24" keyed lockable, access door, key shall be compatible to the owners HL302 key, to service check valve, ball drip and low point drain. Provide one key for each location and store in sprinkler cabinet.

B. At the low point near each fire department connection, install a 90-degree elbow with drain connection to allow for system drainage to prevent freezing. Basis of Design: Victaulic #10-DR.

V. Sprinkler Zone Graphic

A. Provide two sets of small scale floor plans showing the sprinkler zone diagram graphic. The graphic shall show the outline of the entire school, all rooms and corridors with multiple floors shown separately. The sprinkler zones, as shown on the drawings shall be delineated with each zone shown in a different color. The number of each zone shall be shown in its respective area and the graphic shall be titled "Sprinkler Control Zones". The graphic shall show the Siamese connection, the locations of all control, zone, test and drain valves, all low point drains, bulk drains, fire department connection drain, hose valves and shall identify the zone the valve serves and its function. The graphic shall have minimum dimensions of 11”x17” for elementary,middle, high and secondary schools. Larger drawings shall be provided if the minimum dimensions are too small to convey the required information legibly. The graphic shall be laminated. The graphic shall be professionally produced; hand shading will not be accepted. Provide shop drawings on this graphic with sprinkler shop drawings.

B. One zone diagram shall be wall mounted next to the sprinkler service entrance and shall be framed and covered by 1/8" clear plastic. The second zone diagram shall be turned over to the owner for sprinkler shop records.

VI. Valves

A. Sprinkler system valves shall be as manufactured by STOCKHAM, MILWAUKEE, NIBCO, MUELLER, UNITED, VICTAULIC, KENNEDY or any manufacturers listed in section 2.02. Butterfly valves as manufactured by Central are not acceptable. The minimum working pressure for system components shall be 250 psi. All valves controlling the flow of water to sprinklers shall be listed indicating valves. The main system control valve shall be an O.S. & Y, equal to VICTAULIC SERIES 771H. type; other control valves may be with grooved ends or wafer type (butterfly), equal to VICTAULIC SERIES 705. Butterfly valves shall include a pressure responsive seat, and the stem shall be offset from the disc centerline to provide complete 360-degree circumferential seating. Auxiliary control valves, (elevator shaft, pit and machine room), shall be slow close ball valves, equal to VICTAULIC SERIES 728 (MILWAUKEE series BB-SCS). All control valves shall be provided with tamper switches. All valve actuators shall be weatherproof. Fire department connection check valves shall incorporate upstream and downstream pressure taps. The inspectors test/drain valve shall be as manufactured by G/J Innovations, Inc. Model Sure-Test, combination test and drain valve with integral sight glass and test orifice. Test and drain valves manufactured by VICTAULIC TestMaster II Style 720, UNITED BRASS or AGF shall also be acceptable.

B. Backflow prevention valve shall be a U.L., listed double check valve assembly including ball type test cocks to protect the potable water supply against backflow from the automatic sprinkler system. Shutoff valves shall be U.L./FM listed, OS&Y type with tamper switches. The assembly shall comply with ASSE 1015 or AWWA C510. The double check valve assembly shall be manufactured by CONBRACO INDUSTRIES, INC., APOLLO VALVES 4SG series. Backflow prevention valves equal to the item specified as manufactured by WATTS, AMES, FEBCO orWILKINS shall be acceptable.

C. Service device valves shall be UL listed and FM approved, with a grooved end ductile iron body. The valves shall be rated for service of 225-psi (minimum). The valves shall be externally resettable, and all internal components shall be replaceable without removing the valve from the installed position. Basis of Design: VICTAULIC Series 751 (alarm valve), Series 769-NXT (preaction / deluge valve), and Series 768-NXT (dry valve, with required air pressure of 13-psi. Approved equal by VIKING will be acceptable.

VII. Piping

A. All main and branch piping shall be schedule 40 or schedule 10 steel pipe. Schedule 10 piping shall only be allowed for piping larger than two inches. No piping less than schedule 10 shall be acceptable. Grooved end fittings shall be ductile iron, short-pattern, with flow equal to standard pattern fittings. Basis of Design: VICTAULIC FireLock, or approved equal.

B. Grooved joint couplings shall consist of two ductile iron housing segments to ASTM A536, pressure responsive gasket to ASTM D2000, and zinc electroplated steel bolts and nuts to ASTM A449. Couplings shall comply with ASTM F1476 Standard Specification for the Performance of Gasketed Mechanical Couplings for Use In Piping Applications.

1. Rigid Type: Coupling housings shall be cast with offsetting, angle-pattern bolt pads to provide joint rigidity and support and hanging in accordance with NFPA-13. Couplings shall be fully installed at visual pad-to-pad offset contact. Tongue-and-recess type couplings, or any coupling that requires exact gapping of bolt pads at required torque ratings, shall be installed in strict accordance with the manufacturer's published instructions.
    a) Basis of Design: Victaulic Style 009-EZ and 107H, Installation-Ready, for direct stab installation without field disassembly, or standard rigid couplings Victaulic Style 005 "FireLock" and Style 07 "Zero-Flex".

2. Flexible Type: For use in locations where vibration attenuation and stress relief are required, and for the elimination of flexible connectors. Basis of Design: Victaulic Installation-Ready Style 177 or Style 77.

C. Spaces with suspended acoustical ceilings shall receive flexible sprinkler drops manufactured by FLEXHEAD INDUSTRIES or VICTAULIC. Union joints shall be provided for all flexible sprinkler drops. Areas without suspended acoustical ceilings shall be hard piped using return bends. Dry pipe systems shall have galvanized piping.

D. FlexHead industries- flexible sprinkler drops, hose assembly shall be stainless steel fully welded non-mechanical fittings, braided, leak tested with minimum one (1) inch true-bore internal corrugated hose diameter. The ceiling brackets shall be galvanized steel attachment type with integrated snap-on clip ends attached to the ceiling using tamper-resistant screws. The flexible hose attachment shall be removable hub type with set screw.

E. Victaulic- flexible sprinkler drops, the sprinkler drops shall be stainless steel, braided with union joints factory tested to 400 psi. No O-rings will be allowed. The flexible drop shall be attached to the ceiling grid using a one-piece open gate stainless steel bracket. The sprinkler heads installed in acoustical ceiling and concealed ceiling shall be factory pre-assembled to the flexible sprinkler drops. The drops shall include all required supports and bracing.

Part 3 - Execution

I. Installation

A. The sprinkler system shall be installed and tested in accordance with NFPA NO. 13 and shall be approved by the local jurisdiction. Two copies of the test results approved by the jurisdiction shall be sent to the Architect.

B. The sprinkler piping shall be installed concealed above the ceiling and be coordinated not to interfere with the ductwork, air devices, lighting fixtures HVAC piping, plumbing piping and other items. All mains shall run below the ductwork and all branches shall be as high as possible. Branch piping that is not installed as high as possible shall be removed and re-installed at the proper height at no additional cost to the owner. Piping shall be arranged to allow for the easy removal of acoustical ceiling tiles, piping shall be a minimum of 6” above ceiling grid.

C. The sprinkler heads in ceilings shall be installed in the center (both longitudinally and laterally) of the ceiling tile in lobbies, corridors and large rooms such as cafeterias, media

centers, libraries, lecture rooms, etc. Sprinkler heads installed in corridor ceilings shall be installed in the center of the corridor. The intent is that when the corridor width allows for a single row of sprinklers, the heads shall align witht the centerline of the corridor. Sprinkler heads in tiles in other spaces shall be installed in the center of tiles in at least the lateral dimension (width).Flexible sprinkler drops shall be installed in the top or side of main or branch piping (see drawing detail) inverted attachment is not acceptable.

D. All sprinkler heads installed within the same room or space, shall be set at a uniform elevation.

E. Test or drain lines shall discharge to the exterior of the building and shall be kept away from any entrances and off of loading docks and sidewalks.

F. Maintain a minimum clearance of 6" between sprinkler heads and any other obstruction such as lighting fixtures, clocks, etc.

G. The fire service main shall be lined piping outside of the building and inside up to the OS & Y valve. If a spool piece is used between the fire line stub and the OS & Y valve then the spool piece shall be galvanized. If the OS & Y valve is rated by the American Water Works Association (AWWA) as suitable for a connection to a potable water system, then no galvanized pipe is required and the OS & Y valve may be attached directly to the fire line stub.

H. The sprinkler system shall be zoned as shown on the sprinkler zone diagram on the drawings. Each zone shall have an inspector’s test and drain valve located off the remote area of the zone.

I. Provide high temperature sprinkler head(s) in the kitchen heat removal hood, Kiln room, near unit heaters and above gas water heaters. Heads installed within ten feet of gas clothes dryers shall be rated at 200º deg F. Heads located in the kitchen heat removal hood shall be located in the corner of the hood opposite the combi-steamer unit and rated at 360°F. Heads located in kiln hoods shall be rated at 286* deg F. Sprinklers in the heat removal hood and in the kiln room shall be white epoxy coated or stainless steel. Provide intermediate temperature, standard response sprinkler head (200°F), at the bottom of the elevator shaft and in the elevator machine room. Provide intermediate temperature, standard response sprinkler head (200°F), in the walk-in freezer.

J. All zone valves, control valves, test valves, hose valves and drain valves shall have laminated plastic labels attached to the valve to identify the zone the valve serves and the function of the valve (i.e. - "Control Valve - Zone 1", "Inspector's Test - Zone 1", “Drain valve – Zone 1”, etc.). Laminated plastic shall be one eighth inch thick, red with white

center core. Labels shall be a minimum of two inch by six inches with a minimum one quarter inch high block lettering. Peel off labels or permanent markers are not acceptable. Pre-manufactured labels with engraved information are acceptable. Where valves are located above ceilings, labels shall be screwed or riveted to the ceiling grid. In addition to the above, where valves are located in spaces which have doors, label with dimensions of 2" x10" shall be installed above the door on the occupied side of the door. Label shall read "Sprinkler control valve zone _ _ _" etc. Labels attached directly to valves shall be attached by a non-ferrous metal chain.

K. Piping shall be substantially supported from the building structure; the support shall be attached to the upper chord of the structure. Attachments shall be made either by welding or using top beam clamps. The supporting of piping from the supports of other disciplines is not acceptable.

L. As phases of construction are completed, the sprinkler system shall be activated for any additions to the building that are turned over to the owner for occupancy. Active sprinkler mains that run through portions of the building without sprinkler protection shall be protected as required by the Fire Marshall or the Authority Having Jurisdiction. Sprinkler valve signs shall be installed in these areas. Sprinkler systems shall remain activated throughout normal school hours and any subsequent connections into active systems shall be made outside of these hours.

M. All dry type sprinklers shall be of the same manufacturer and shall be insulated and sealed around the pipe penetration and shall have a corrosion resistant coating. Walk-in coolers/freezers shall have sprinklers located on opposite side of refrigeration equipment. All dry type sprinklers shall be 12" long unless special conditions require longer lengths.

N. Sprinkler main and branch piping shall be flushed prior to installing any sprinkler heads. Flushing connections shall be provided on mains and shall be 2 1/2". Flushing connections shall consist of threaded nipples with hose valves and caps. Flushing connections shall remain after the flushing and testing has been completed for use as future drain valves. Two flushing connections shall be provided for each zone and shall be located within 50' of operable windows or exterior doors. Flushing connections shall be located on opposite ends of each zone. The flushing of each zone shall be witnessed and verified by the owner's representative.

O. Check valves shall not be mounted higher than five feet above the finished floor.

P. Fire department check valve upstream and downstream pressure taps shall have valves and be provided with capped hose end connections for future maintenance/inspection purposes.

Q. All control and zone valves located in the sprinkler room shall not be mounted higher than five feet above the finished floor.

R. All inspectors' test/drain valves shall be located in chases with keyed alike, lockable access doors, minimum size is 10"x10".. Key shall be compatible with owner's HL302 key. Provide one key for each location and store in sprinkler cabinet.

S. Coordinate the spacing of heads with curtains and folding partitions.

T. Backflow valves shall be tested by an approved testing agency after installation.

U. Provide concealed type sprinkler heads in all group toilets, locker rooms and shower rooms, for all middle, high and secondary schools. Provide concealed type sprinkler heads in bulkheads, and spaces where the ceiling height is 7 foot 6 inches or less. Provide concealed type sprinkler heads at folding partitions as to not interfere with the operation of the folding partition.

V. Piping in exposed areas shall not be painted prior to the Fire Marshall approval of hydrostatic testing.

W. The use of piping bushings is not acceptable.

X. The shortest suitable length flexible braided sprinkler drop shall be used, however, avoid excessively shard bends or stress at the takeoff from the branch line or main.

Y. The sprinkler bulb protector must remain in place until the sprinkler is completely installed and before the system is placed in service. Remove bulb protectors carefully by hand after installation. Do not use any tools to remove bulb protectors.

Z. Do not install sprinklers that have been dropped, damaged, or show a visible loss of fluid. Never install sprinklers with cracked bulbs.

AA. Grooved joints shall be installed in accordance with the manufacturer's written recommendations. Grooved ends shall be clean and free from indentations, projections, or roll marks. The gasket shall be molded and produced by the coupling manufacturer of an elastomer suitable for the intended service.

II. Spare Parts

A. Provide and install cabinet adjacent to sprinkler service with spare heads, escutcheons, and wrenches for each type of sprinkler used including, but not limited to, all dry type and concealed heads, in accordance with the following schedule:

TOTAL NUMBER OF SPRINKLERS	NUMBER OF SPARE SPRINKLERS REQUIRED
1-10	1
11-299	6
OVER 299	12

B. All dry sprinklers shall be provided by the same manufacturer. Spare sprinklers shall be the same as those used on the project (temperature, color, length, etc.)

C. Provide a spare sprinkler wrench for each type of sprinkler and provide PVC sleeves with screwed caps to house dry type sprinklers. Hang sleeves on wall adjacent to sprinkler cabinet(s). Provide allen keys for flow/tamper covers.

D. Provide two spare flexible sprinkler drops for each length used. Provide bracket and hardware for each flexible sprinkler drop.

E. Provide one set of Backflow Preventer repair kit.

F. Spare wrench for recessed heads shall be socket type.

III. Special Conditions

A. The kitchen, all storage, mechanical, science rooms and science prep rooms shall be designed for Ordinary Hazard, Group One.

B. Sprinkler heads needed for sprinkler system design but not specifically referenced under paragraph 2.02 will be considered on a case by case basis.

C. Systems utilizing bulk mains, as shown on contract drawings, shall have zone valve assemblies located as shown on these drawings. The zone valve assembly shall consist of a control valve with tamper switch, a check valve and a flow switch.

D. Inspector test valves for attic dry pipe systems shall be installed in the space below, with drum drip and keyed, access door.

E. Pool areas shall use galvanized piping and sprinkler heads with corrosion resistant coatings.

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 - General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods shall apply to this section.

II. Scope
   A. A complete fire pump system shall be installed.

III. Quality Assurance
   A. A fire pumping system shall be installed and tested to meet the requirements of NFPA 20 Centrifugal Fire Pumps, state codes and the local jurisdiction.

IV. Submittals
   A. Provide shop drawings on the complete fire pump system as described in Section 230100 - 1.04.

Part 2 - Products

I. Fire Pump
   A. Furnish and install as indicated on the drawings an electric horizontal motor driven fire pump complete with control panel, valves, check valves, bypass, pump test header, relief valve, strainers, jockey pump, and jockey pump control panel.
      1. Fire pump shall be a packaged system mounted on a common base of fabricated steel and shall be U. L. and F. M. approved for fire protection equipment. Acceptable manufacturers include:
         a) Peerless
         b) Syncroflow
         c) Tigerflow.
      2. Fire pump shall be a (select) G. P. M. at a design head of (select) PSI,(select) HP(select) volt, 3 phase, 60 hertz, rate at 3525 RPM, motor shall be provided by the pump manufacturer, in accordance with NFPA 20 with all accessories for automatic operation.
   B. The fire pump controller shall be as manufactured by Firetrol Inc. The fire pump controller shall be automatic stop with timer and shall be identified "Fire Pump Controller". Fire pump controllers fully equal to the item specified, approved by the engineer, shall be acceptable.

C. The fire pump controller shall be U.L. listed and factory mutual approved for fire pump service and horsepower rating of the fire pump motor.

D. The fire pump controller shall have a service rated disconnect and shall be a solid state limited service with across-the-line starting type for fire pumps under 30HP and full service with across-the-line starting type for fire pumps 30HP and greater.

E. The fire pump controller shall have an interrupting capacity of at least 65,000 AIC.

F. Provide one set of dry contacts within the fire pump controller for connection to the owners security intrusion system, contacts shall make on pump run, (wiring to security system by others).

II. Jockey Pump

A. Furnish and install a jockey pump as indicated on the drawings to maintain pressure in the fire protection system complete with specialties as listed in 2.03 and controller.

1. The jockey pump shall be a (select) H.P., turbine type, (select)____ volts, 3 phase, 60 hertz, at 3450 R.P.M. as manufactured by Burks Pump. Jockey pumps fully equal to the item specified, approved by the Engineer, shall be acceptable.

2. The jockey pump controller shall be U.L. listed and factory mutual approved for fire service. The jockey pump controller shall incorporate a full voltage magnetic starter, fusible disconnect switch that is service rated, hand-off-auto selector switch, pressure switch and red pilot light. The jockey pump controller shall be as manufactured by Firetrol, Inc. The jockey pump controller fully equal to the item specified approved by the Engineer shall be acceptable.

III. Specialties

A. Specialties shall be provided to meet the requirements of NFPA 20 including but not limited to pipe, fittings, valves, check valves, eccentric reducers, concentric increasers, strainers, relief valves, pressure gauges, pressure switch including wiring and air vents. A ceiling lifting lug shall be provided directly over the fire pump motor. The lifting lug shall be sized to lift no less than 400 Lbs.

IV. Test Manifold

A. The test manifold for fire pump test connection shall be as shown on the drawings. The flush type wall hydrant shall be cast brass, double inlet body with male NPT inlet(s) and furnished with caps and chains, and cast brass escutcheon plate marked "Pump Test Connection". Finish shall be polished chrome plated, size 6" x 2-1/2" x 2-1/2", as manufactured by Potter-Roemer, Model 5862-7, complete with male snoots, caps and chains and removable swivel hose valves. Provide automatic ball drip. After the tests are

complete and approved, the valves shall be removed and stored in lockable wall cabinet, 20" x 20" x 9", with solid door, as manufactured by Potter-Roemer, Model 1815. Locate cabinet in pump room. Pump test manifolds fully equal to the item specified, manufactured by Allenco, Seco, or Elkhart, and shall be acceptable.

Part 3 - Execution

I. Installation
   A. The fire pump system shall be installed and tested as shown on the drawings and specified herein and in accordance with NFPA 20, state and local codes. Two copies of the test report approved by the local jurisdiction shall be submitted to the Owner.
   B. The fire pump supplier shall provide the services of a factory qualified technician to align pump coupling and check all items prior to fire pump test. Provide the owner with a copy of this report.
   C. Relief valves that discharge into floor drains shall not cause splashing of water in the pump room.
   D. Unless prohibited by code, drains shall discharge to the exterior of the building.
   E. Install unions to facilitate the replacement of relief valves on the fire pump and jockey pump.
   F. All piping shall be properly supported with hangers or clamps.
   G. All drain lines for drip cups and relief valves shall be PVC, CPVC or copper pipe.

II. Tests
   A. The automatic fire pump shall be tested for capacity and flow in accordance with NFPA 20.
   B. All labor, tools, materials and the services of an electrician shall be provided by the Fire Protection Contractor for all required automatic fire pump tests.

END OF SECTION

Part 1 - General

I. Summary
   A. This Section includes hangers and supports for mechanical system piping and equipment.

II. Performance Requirements
   A. Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
   B. Design heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
   C. Design and obtain approval from authorities having jurisdiction for seismic-restraint hangers and supports for piping and equipment.

III. Submittals
   A. Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.
   B. Shop Drawings: Signed and sealed by a qualified professional engineer for multiple piping supports and trapeze hangers. Include design calculations and indicate size and characteristics of components and fabrication details. This requirement may be modified in writing, for specific applications.
   C. Welding certificates.

IV. Quality Assurance
   A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

Part 2 - Products

I. Manufacturers
   A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
      1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

II. Manufactured Units
   A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components.
   B. Approved manufacturers:

1. AAA Technology and Specialties Co., Inc.
2. B-Line Systems, Inc.
3. Carpenter & Patterson, Inc.
4. Empire Tool & Manufacturing Co., Inc.
5. Globe Pipe Hanger Products, Inc.
6. Grinnell Corp.
7. GS Metals Corp.
8. Michigan Hanger Co., Inc.
9. National Pipe Hanger Corp.
10. PHD Manufacturing, Inc.
11. PHS Industries, Inc.
12. Piping Technology & Products, Inc.
13. Approved Equal.

C. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.

D. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

III. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.

A. Manufacturers:

1. B-Line Systems, Inc.
2. Grinnell Corp.
3. GS Metals Corp.
4. Michigan Hanger Co., Inc.
5. National Pipe Hanger Corp.
6. Thomas & Betts Corp.
7. Unistrut Corp.
8. Wesanco, Inc.
9. Approved Equal.

B. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

C. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

IV. Thermal-Hanger Shield Inserts: 100-psi minimum compressive-strength insulation, encased in sheet metal shield.

A. Manufacturers:

1. Carpenter & Patterson, Inc.
2. Michigan Hanger Co., Inc.
3. PHS Industries, Inc.
4. Pipe Shields, Inc.
5. Rilco Manufacturing Co., Inc.
6. Value Engineered Products, Inc.
7. Approved Equal

B. Material for Cold Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.

C. Material for Hot Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate.

D. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.

E. For Clevis or Band Hanger: Insert and shield cover lower 180 deg rees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

V. Miscellaneous Materials

A. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

C. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

D. Grout: ASTM C 1107, Grade B, factory-mixed and -packaged, non-shrink and nonmetallic, dry, hydraulic-cement grout.

1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
2. Properties: Non-staining, non-corrosive, and non-gaseous.
3. Design Mix: 5000-psi, 28-day compressive strength.

Part 3 - Execution

I. Applications

A. Specific hanger requirements are specified in Sections specifying equipment and systems.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.

C. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, ½" to 30" NPS.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, 4" to 16" NPS, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, ¾" to 24", requiring clamp flexibility and up to 4 inches of insulation.
4. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, ½" to 8" NPS.
5. U-Bolts (MSS Type 24): For support of heavy pipe, ½" to 30" NPS.
6. Pipe Saddle Supports (MSS Type 36): For support of pipes, 4" to 36" NPS, with steel pipe base stanchion support and cast-iron floor flange.
7. Single Pipe Rolls (MSS Type 41): For suspension of pipes, 1" to 30" NPS, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
8. Complete Pipe Rolls (MSS Type 44): For support of pipes, 2" to 42" NPS, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

D. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, ¾" to 20" NPS.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, ¾" to 20" NPS, if longer ends are required for riser clamps.

E. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

F. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
   a) Light (MSS Type 31): 750 lb.
   b) Medium (MSS Type 32): 1500 lb.
   c) Heavy (MSS Type 33): 3000 lb.
8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

G. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
   1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
   2. Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.
   3. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi minimum compressive-strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.

H. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
   1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
   2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.

3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.

II. Installation

A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems. Field assemble and install according to manufacturer's written instructions.

C. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes. Support pipes of various sizes together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

D. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

E. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

F. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.

K. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.
    a) Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b) Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c) Do not exceed pipe stress limits according to ASME B31.9.
2. Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span arc of 180 degrees.
4. Shield Dimensions for Pipe: Not less than the following:
    a) ¼" to 3 ½" NPS: 12 inches long and 0.048 inch thick.
    b) 4" NPS: 12 inches long and 0.06 inch thick.
    c) 5" and 6" NPS: 18 inches long and 0.06 inch thick.
    d) 8" to 14" NPS: 24 inches long and 0.075 inch thick.
    e) 16" to 24" NPS: 24 inches long and 0.105 inch thick.
5. Pipes 8" NPS and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

III. Equipment Supports

A. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor. Place grout under supports for equipment and make smooth bearing surface.

IV. Metal Fabrication

A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations. Comply

with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

V. Adjusting

A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

VI. Painting

A. Touching Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils. See Division 9 Section "Painting" for paint materials and application requirements.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 -General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope
   A. This section consists of providing the waste, vent and sanitary sewer system, domestic cold and hot water supply system and all fixtures, equipment, accessories and appurtenances.
   B. Permits, Codes & Standards:
      1. Plumbing systems shall be designed in compliance with all codes and standards as cited previously. Comply with all WSSC plumbing and gas fitting regulations.
      2. Permits will be obtained and fees paid by PGCPS. The contractor shall transfer the permits, pay only the transfer fee and comply with all WSSC regulations.
      3. Comply with Prince George's County plumbing and gas fitting regulations.

III. Quality Assurance
   A. The roof drainage system shall be tested for leaks before the insulation is applied and before the piping is covered up. The test shall be filling the system with water.

IV. Submittals
   A. Gas Service:
      1. At the Design Development phase, design engineer shall verify with the gas providing utility that sufficient gas service is available for the project.
      2. Design engineer shall submit gas service request to the providing utility. Some projects may be serviced by Baltimore Gas & Electric; the majority are served by Washington Gas Co. Service request shall be issued at the 95% complete construction document phase, copying the PGCPS Project Manager. Service request to Washington Gas shall be made on their Commercial Service Request Form, addressed to:

         Sales Rep. – Prince George's County
         6801 Industrial Road
         Springfield, VA 22151
         Room 202K

B. Plumbing Permit Drawings:
   1. At the 95% design completion submission, two (2) complete sets of plumbing drawing shall be provided to the PGCPS Project Manager, stamped and signed by the design team's plumbing professional engineer. PGCPS will submit the stamped drawings to WSSC for review and approval. WSSC review comments shall be addressed and incorporated into the 100% completed (bid) documents. PGCPS will provide the WSSC approved drawings to the plumbing contractor.
   2. Two (2) stamped and signed civil site utilities plans are also to be provided to the PGCPS Project Manager at the 95% design completion submission for the permit review submission to WSSC.

C. Leed: Require that the contractor:
   1. Submit MSDS or product data for each field-applied adhesive or sealant used, highlighting VOC and formaldehyde content.
   2. Submit certified water usage rating for each plumbing fixture. The target ratings shall be indicated on the Construction Documents under the fixture schedule.

Part 2 - Products

I. Drainage, Waste And Vent Pipe And Fittings:
   A. Above Grade:
      1. Allowable piping consists of the following: Copper tubing type DWV, schedule 40 PVC, or hubless cast iron pipe; Corresponding fittings shall be wrought copper, schedule 40 PVC, or no-hub cast iron. PVC cannot be used in plenum ceiling cavities.
      2. All exposed or semi-exposed waste piping in kitchens to be type L copper DWV
      3. Foam core piping not allowed
      4. Piping sealants, adhesives and welding cements field-applied in the interior of the building shall comply with the following VOC content limits (in grams/ liter):
         a) PVC Welding: 510
         b) ABS Welding: 400
         c) Plastic Cement Welding: 350
         d) Adhesive Primer for Plastic: 650
         e) All Other Welding & Installation Adhesive and Sealants: 250

f) Specify that “All Weather” welding cement be used on plastic piping when outdoor air temperatures are below 40°F.

B. Below Grade: Service weight cast iron, hub and spigot or Schedule 40 PVC pipe. Fittings to match piping.

II. Gas Pipe And Fittings:

A. Materials shall be schedule 40 steel pipe; threaded malleable iron fittings for piping 2” and smaller. Weld fittings shall be utilized for piping 2-1/2” and larger.

III. Domestic Water Piping, Valves, And Accessories

A. Above Grade: Copper tubing, hard drawn, type L; wrought copper fittings, solder joint

B. Below Grade:

1. Piping, 2-1/2" and smaller, type K
2. Piping, 3" and larger, ductile-iron
3. Pipe fittings: Cast bronze flared for K tubing; gasket and bolted flanges for ductile-iron

C. Dielectric connections: dielectric flanges, couplings, or nipples. Dielectric unions prohibited.

D. Valves: Ball or globe. Gate valves prohibited except for OS&Y type required for incoming water service.

IV. Acid Resistant Piping And Accessories

A. Above/Below Grade: Polypropylene tubing, connections shall be mechanical joints or electrofusion systems; CPVC Type IV Grade I compounds with a minimum cell classification of 23447, pipe and fittings shall conform to ASTM F2618 and solvent cement shall be formulated for chemical waste and confirm to ASTM F493

B. Neutralization: Means of neutralization shall be performed passively through a centralized polypropylene tank or through individual sink mounted basins. Limestone chips shall used for the neutralization/dilution process.

V. Plumbing Fixtures:

A. General: Plumbing fixtures shall be of manufacturers listed; fixtures, fittings, trim and accessories shall be same manufacturers to the extent possible.

1. Vitreous China Fixtures: American Standard, Kohler, Zurn, Crane
2. Stainless Steel Fixtures: Just, Eljer, Kohler, Elkay
3. Enameled Cast Iron: American Standard, Kohler, Zurn
4. Faucets: T&S Brass, Chicago, Symmons, Delta, American Standard, Zurn, Speakman, Moen

5. Flush Valves: Sloan, Zurn, Speakman, Moen
6. Emergency Fixtures: Bradley, Speakman, Guardian, Haws

B. Fixtures Basis of Design:

1. Water Closets: All shall be white vitreous china, floor mounted; no wall mounted water closets.
   a) Standard: Elongated bowl, siphon jet, NPS 1-1/2" (DN 40) top spud, 2-1/4" passageway, floor mounted, 1.6 gpf, heavy duty solid plastic open front seat less cover with S.S. hinge posts with combination self-sustaining and check hinge, dual-flush valve (1.6/1.1 gpf).
   b) ADA/Child: Reference above standard, mounted per Table 3.1 B
   c) Tank Type: Tank types shall not be used.
   d) Flush Valves:
      (1) Single action valves shall be 1.6 gpf.
      (2) Two-stage "dual-flush" valves shall be 1.6/1.1 gpf.
      (3) Automatic flush valves will not be accepted.
   e) Mounting: Water closets shall be secured with two bolts attaching to the floor flanges and the base shall be sealed to the floor using a clear silicone caulk. Secure with bolt caps.
2. Urinals:
   a) Wall hung, white vitreous china, 1.0 gpf, top spud, rear outlet; washdown action, flush valve.
   b) Waterless urinals are not acceptable at this time.
   c) Carriers: Wall-mounted carrier shall have top and bottom support plates, anchored to floor with foot supports.
3. Lavatories: White vitreous china, wall hung.
   a) Standard: Rectangular (20 x 18), front overflow, 4" centerset 0.5 gallon-per-minute faucet, grid strainer, wall mounted. Theft protected aerators in middle and high schools
   b) Kindergarten: Rectangular (21.25 x 18), front overflow,(grid strainer, 4" centerset 0.5 gallon-per-minute faucet, wall mounted.
   c) Supplies shall be 1/2" copper to faucet, loose key stops, 1-1/2" x 1-1/4" cast brass P-trap with clean-out and threaded outlet.
   d) All public lavatories shall receive a tempering valve conforming to latest ASSE 1070 requirements. Automatic faucets are not acceptable.

4. Sinks:
    a) Classroom Countertop: Stainless steel, single compartment, with seamless radius-coved corners, 3-hole ledge for faucet, 8" faucet centers, 5-1/2" deep, limited swing gooseneck faucet, wrist blade handles, duo strainer. Offset drain to comply with ADA requirements as necessary.
        (1) Supplies and trap per lavatories above.
        (2) Drinking bubblers shall be provided on all handicapped sinks and on all elementary school sinks.
        (3) Art room sinks shall have plaster traps (1.5 x 1.5) IPS outlet, cast-brass, ground joint, swivel type, with cleanout, complete with NPS 1.5 cast-brass nipple and cast setscrew escutcheon.
    b) Mop: Pre-cast terrazzo basin (24 x 3), 18-gage; wall mounted faucet with 3/4" hose thread, vacuum breaker, integral stops, wall brace, pail hook, hose and hose bracket, strainer (1453-BB); stainless steel edge curbs and wall guards.
    c) Service: Enameled cast iron with rim guard and wall hanger. Heritage 8341.075 faucet, trap standard. Provide a double sink in concession stands.
5. Showers:
    a) Group: Concealed metering shower valve with 30 second cycle or better (Leonard LV- 477B), H-06 shower head; Leonard Group Shower Control (TM-186 series) thermostatic mixing valve in locking recessed stainless steel cabinet.
    b) Group, Barrier Free: Concealed metering shower valve with 30 second cycle or better (Leonard LV-477B); 501P(G) hand held shower, 69" chrome hose and rail; Leonard Group Shower Control (TM-186 series) thermostatic mixing valve in locking recessed stainless steel cabinet.
    c) Staff, Barrier Free: Floor and enclosure by General Contractor. Leonard 4500-S-501P(G) temp/pressure balancing valve, fixed shower head and hand held shower, 69" chrome hose and rail.
    d) Free stand-in showers will not be allowed.
6. Water Coolers: Dual, two level; Elkay, Ebco, Haws, Halsey-Taylor, Oasis; HFC-134a refrigerant; barrier free, certified lead free, manual control. Support framing shall be made of heavy gauge galvanized steel with pre-punched mounting holes and mounted to the floor. Provide necessary filters as required.

7. Emergency Fixtures: Combination shower and eye/face wash unit shall be installed for each science classroom. Shower shall operate utilizing a pull rod and eye/face wash shall utilize highly visible push handle. Comply with ANSI Standard Z358.1 by providing uninterruptible supply of flushing fluid at a minimum of 30 PSI flowing pressure. Per ANSI Standards and Code requirements water temperature provided to emergency equipment shall be tepid. Provide floor drain at the base of each shower fixture.

VI. Specialties:

A. Traps: All traps for lavatories, electric water coolers, classroom sinks, etc. shall be cast brass, with cleanout and threaded outlet.

B. Thermostatic Mixing Valves: Lawler, Leonard model to match flow requirement.

C. Wall Hydrants: Freezeless, male hose thread, vacuum breaker, backflow preventer, loose key stop, chrome. Josam Series 71050; Jay R. Smith, Zurn.

D. Hose Bibbs:

1. Cold Water: Male hose thread, vacuum breaker, backflow preventer, loose key stop, chrome.
2. Hot and Cold Water: Two handle mixing faucet with lever handles, male hose thread, vacuum breaker, backflow preventer, loose key stop, chrome.

E. Open Site Drains: Floor drain with funnel. Josam Series #30000-E2, J.R. Smith, Zurn.

F. Floor Sinks: Josam Series #49000, J.R. Smith, Zurn. Install 1” AFF.

G. Roof Drains: Josam Series #21000-T with threaded outlet and drain receiver, J.R. Smith, Zurn.

H. Clean Outs: Josam, J.R. Smith , Zurn

1. Floor: Satin Nikolay Finish
2. Wall: Stainless steel access cover . Distance between wall cover and cleanout shall not exceed 4”.
3. Exterior: Satin Nikolay Finish

I. Backflow Preventers: Comply with WSSC

J. Trench Drains: Install trench drains in each trash room as indicated on Architectural documents. Cast-iron rectangular sectional body with 6” wide cast-iron grate meeting ADA requirements. Josam Series 76000. Install 1/8” screen over drain outlet.

K. Shock Absorbers (water hammer arresters): stainless-steel bellows type, certified in accordance with PDI WH 201, Water Hammer Arresters, equal to Zurn “Shoktrol” Z-1700.

VII. Insulation:

A. Fiberglass with all service jacket. Flexible elastomeric insulation may be used for piping drops within partitions. All joints to be properly sealed and inspected.

VIII. Identification:

A. Valves Tags: Brass circular tag with chain to identify system and valve number.

B. Where valves, equipment, pumps, etc. are concealed above ceilings provide plastic labels on grid below. Labels shall be black with white letters and should be the size of the grid tee. Label shall be provided with adhesive backing for attachment. Label shall indicate the tagging information and system.

C. Valve tag chart shall be provided and mounted in the boiler or mechanical room. Chart shall be laminated and framed.

Part 3 - Execution

I. Fixture Requirements:

A. Number of plumbing fixtures required: Reference International Plumbing Code for all code requirements related to plumbing fixture type and quantities. Student occupancy load shall be based on project specific educational specifications. Elementary classrooms with individual restrooms shall deduct 25 students per classroom from the overall occupancy load. Use the following list as a guide for minimum requirements:

	Fixture	Gender Use	Multiplier	# Fixture
(1) Students*	Water closet	M	.5	1 per 20
	Water closet	F	.75	1 per 20
	Secondary - Shower	M	.5	1 per 25
	Secondary - Shower	F	.5	1 per 25
	Lavatories	Both	-	50% of WC count
	Drinking Fountain	Both	-	1 per 100
(2) Staff*	Water closet	M	.5	1 per 25
	Water closet	F	.5	1 per 25

	Lavatories	Both	-	1 per 25
(3) Assembly Area*	Water closet	M	.5	1 per 50
	Water closet	F	.75	1 per 50
	Lavatories	Both	-	.5X # of Water closet
	Drinking Fountain	Both	-	1 per 500
*NOTES:	1. At least one of each fixture per bathroom shall be for handicapped use. 2. Urinal fixture count shall be included in water closets but not to exceed 50%. 3. Drinking fountain count based on total census 4. Provide at minimum (1) service sink per floor 5. Restrooms for public use shall be clearly identified. 6. Provide 1 shower per 0.5% of full-time staff to satisfy LEED requirements for Site Credit 4.2. – PE Staff Showers can be used to comply with this credit if easy access is provided and school has policy that allows all staff to use the PE showers.			

B. Fixture mounting heights: Standard primary and secondary school height of fixtures:*

Fixture	K	1 thru 3	4 thru 5	Middle School	High School	Adult
Lavatories	24"	28"	28"	31"	31"	31"
Water Closet	15"	15"	15"	15"	15"	15"
Urinals	16"	16"	16"	24"	24”	24”
Lavatories (Handicap)	24"	28"	28"	34"	34"	34"
Water Closet (Handicap)	15"	15"	15"	15"	16.5 - 17"	16.5 - 17"
Urinals (Handicap)	16"	16"	16"	16"	16"	16"
Electric Water Cooler (EWC)	25"	31"	31"	31"	31"	31"
E.W.C. (Handicap)	28"	34"	34"	34"	34"	34"

NOTES:
1. Heights are to rim for water closets and to lip for lavatories AFF
2. Pre-K Water Closets shall be 10” in height.

II. Drainage:

A. Provide lead flashing for vent lines. Extend minimum of 12" above roof. Do not locate vent lines within 25 feet of ventilation air intakes as required by International Mechanical Code and comply with Ventilation Rate Procedures of ASHRAE Standard 62.1. If discrepancy exists follow whichever is more stringent.

B. Roof drains must have secondary overflow drainage; water dam shall extend 3” above roof. Downspout nozzles for overflow piping to have stainless steel screens.

C. Use cast iron square boots down spouts

D. Require pipe hanger at piping connect to roof drains. Hanger shall be located directly adjacent to 90 degree bend.

E. Provide a oil monitoring sump pump in all elevator pits. Pump controller shall be mounted in nearest mechanical or building service space. Unit shall be Stancor SE-50 or equal.

F. Specify that “All Weather” welding cement be used on plastic piping when outdoor air temperatures are below 40°F.

G. Existing:

1. All existing to remain underground utilities are the general contractor’s responsibility to minimize disruption and maintain designed functionality.
2. In general, all existing sewer and storm drain lines should be replaced in full modernization projects. If PGCPS directs the A/E to maintain existing drain line in some modernization and addition projects, the following paragraph shall be placed on the plumbing drawings:

   Prior to starting any work; the contractor shall test and accept all roof drains, sewer and storm drains as free flowing and in working condition. Testing shall be performed in the presence of PGCPS maintenance personnel and PGCPS Plumbing Inspector.

H. The contractor shall take full responsibility for protecting all drains during the construction and returning them free flowing and in working condition. Contractor shall guarantee all drains for at least 90 days after occupation of the building.

I. Floor Drains, Cleanouts:
   1. Floor drains and cleanouts are to be installed prior to concrete floor pours.
   2. Trap primers:
      a) Provided from flush valves where possible
      b) Provided with time clock control when not from flush valve. Assure coordination with electrical (Div 16) regarding power to trap primers.
      c) Trap priming piping to be reinforced copper tubing; no PVC

J. Waste Disposals: Waste disposals are prohibited.

III. Domestic Water:

A. Sterilization: Domestic water to be disinfected by a certified water-treatment company. A letter of certificate must be submitted to the owner, before building is occupied.

B. If outdoor play-fields are provided with sprinkler system, require a registered submeter to exempt the water usage from sewage charges.

C. Provide a pressure regulator in the incoming water after the backflow preventer on incoming water service when pressure may exceed 60 psig at fixtures.

D. Domestic circulation temperature shall be a minimum of 120 degrees unless otherwise approved. Mop basins and specified kitchen fixtures shall receive 120 degree hot water.

E. Fixture Supplies:
   1. Locate rough-in for ADA water closets so that the handle is on the wide side of the stall.
   2. Urinals with 1.0 gpf flush valves shall be provided with 3/4” cold water supplies.

F. Science Lab Classrooms: Provide central water shut-off valves in teacher’s workstation casework to permit teacher control of water to all student sinks in the classroom.

G. Group shower mixing valve and shut off valves shall be installed in recessed locking wall cabinet.

IV. Insulation:

A. Storm: 1” thickness
   1. Drain basket
   2. Horizontal piping and first 2 feet in the vertical direction
   3. Ground floor level: five feet AFF

B. Domestic Water:
   1. Cold Water: 1” thickness.
   2. Hot Water: 1” and smaller piping: 1” thickness. 1-1/4” piping and larger: 1” thickness.
   3. Recirculating Hot Water: 1/2” thickness.

4. Insulation shall be continuous over all plumbing valves. Provide valve handle extensions for all insulated valves.
5. Fittings shall be covered with same thickness as piping with molded PVC jacket.
6. Insulation for piping outdoors shall have aluminum jackets; seams at bottom of piping.

C. Handicapped Lavatories: Pre-molded trap and valve insulation shall be applied to supplies and drains below fixture.

V. Gas:

A. Provide dual gas pressure system. Medium press (2 lbs) for boilers, generators, and long runs to HVAC equipment and science applications; pressure regulators located at equipment; low press (7" WC) for hot water heater, science, and kitchen use.

B. Provide cocks, regulators, unions and test port at equipment connections.

C. All gas regulators shall be vented to outdoors; vent piping shall be shown on contract drawings.

D. Science Lab Classrooms: Provide key switch in teacher's workstation casework to permit teacher control of gas to all outlets in the classroom. Provide mushroom style push button at classroom exit for emergency gas shut down. Provide solenoid valve on gas service to classroom to shut off gas in response to emergency gas shut down; teacher's switch opens valve.

VI. Coordination With Other Disciplines/trades:

A. Plumbing engineer shall ensure that other disciplines are cognizant of these PGCPS standards for fixtures and fittings being specified by them; i.e. laboratory fixtures and trim specified by the Architect, food service sinks specified by the Food Service Consultant, etc.

B. Coordinate with the other disciplines and clearly delineate the responsibilities of the plumbing contractor; i.e. rough-in for and make final connections to fixtures and fittings furnished and installed by others; rough-in for and install fittings furnished for fixtures provided by others; rough-in for and install fixtures and fittings furnished by others; etc.

C. Coordinate services with civil discipline; sizes, locations, and inverts are to be fixed no later than the 65% design review submission.

VII. Radon Venting:

A. Radon vent system shall be provided for every 5,000 sq.ft. of building slab. Individual vents shall be shown on contract drawing floor plans; installation per detail and to include mini magnehelic.

VIII. Leed Requirements:

A. Recycle waste piping materials in accordance with Division 1 Construction Waste Management Requirements.

B. Provide a separate meter on any rainwater harvesting system.

IX. Installing Roof Drains

A. The first fitting below the roof drain shall be a T without cleanout plug, except over food preparation and serving areas.

B. Set roof drains so flashing clamp ring is depressed below normal roof membrane level. Flashing of the roof drains shall be as specified in Division 7.

C. Sheet lead gaskets shall extend 12 inches (305 mm) beyond outer edge of roof drains and shall be secured with the flashing clamp.

D. Flashing clamp ring shall be embedded into the roofing and made watertight.

E. Ascertain that weep holes into drainage pans are open.

X. Installing Water Hammer Arresters (shock Absorbers)

A. Install water hammer arresters in each branch domestic water pipe (hot and cold) which feeds either a battery of fixtures or a single fixtures with self closing faucet valves or flush valves.

B. Size and locate in the piping as shown on drawings and as recommended by the Plumbing and Drainage Institute.

XI. Installing Sleeves

A. Install sleeves for piping, or piping with insulation continuous through sleeve, passing through walls, partitions, beams, or slabs. Sleeves through concrete floors shall be set prior to concrete pour.

1. Exception: Where steel pipe penetrates a steel beam that is not part of a fire-or smoke rated assembly, no sleeve is required.

B. Do not cut, drill, or burn structural steel for installation of piping without specific instructions from the Architect.

C. Locations in non fire-rated construction:

1. Install sleeves for penetrations of steel, iron, and insulated piping.
2. Install copper sleeves for penetrations of uninsulated copper tubing and piping.
3. Install plastic sleeves for penetrations of plastic piping. Plastic piping and sleeves are not permitted in ceiling spaces used as HVAC system plenums, nor in shafts used for building HVAC air distribution.

D. Locations in floors and fire-rated construction: Sleeves used in piping penetrations through fire rated construction shall be an acceptable component of the through-penetration firestop assembly as specified in Section 15079 Firestopping for Mechanical Work.
   1. Where firestop assembly is UL listed, sleeve material shall be as directed in the listing.
   2. Where other specified approval and acceptance is required, sleeve shall be as described in the approved assembly.

E. Install Sleeves through walls and partitions flush with finished surfaces.

F. Sleeves through floors shall extend 0.375 inch (10 mm) above top of finished floor and be finished neat and level. Sleeves through mechanical or equipment room floors shall extend 2 inches above finished floor. Provide projecting sleeves with anchor clips to prevent them from being loosened and knocked down in the floor construction.

G. Sleeves for penetrations in kitchen and food service areas shall finish 0.375 inch (10 mm) above floor or flush with wall surfaces and be neatly pointed up to fit snuggly against floor or wall materials. Seal space between pipe and sleeve with waterproof sealant or fire barrier as required, and finish even with wall or floor with a light pouring of molten lead.

H. Sleeves for insulated piping with vapor barrier shall be large enough to pass piping and insulation.

I. Seal spaces between sleeves and pipe, or pipe insulation, in nonrated walls, with mineral wool. In rated walls or floors install required fire-rated caulk.

J. Penetrations in exterior masonry or concrete walls and foundations:
   1. Sleeves: cast iron, or in cast concrete may be core drilled.
   2. Above grade: Oakum and lead, or mechanical penetration seal, at outside face of wall.
   3. Below grade: Mechanical penetration seals at outside and inside faces of wall. Link-seal or equal.

XII. Schedules

SYSTEM	TEST PRESSURE PSIG (kPa)	ALLOWABLE DROP	MEDIUM
Domestic water, cold & hot, and recirculated	125 (860)	None	Water

Heating water	125 (860)	None	Water
Chilled and chilled/heating water	125 (860)	None	Water
Sprinkler water and fire line	200 (1370)	None	Water
Air conditioning condensate drain	4.3 (30)	None	Water
Pumped storm	125 (860)	None	Water
Storm	4.3 (30)	None	Water
Fuel gas	100 (690)	None	*Nitrogen or air

END OF SECTION

Part 1 - General

I. Summary
   A. This Section includes domestic water piping from locations indicated to fixtures and equipment inside the building.
   B. See Division 23 Section "Meters and Gages" for thermometers, pressure gages, and fittings.

II. Submittals
   A. Water Samples: Specified in "Cleaning" Article in Part 3.
   B. Field quality-control test reports.

III. Quality Assurance
   A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
   B. Comply with NSF 61, "Drinking Water System Components-Health Effects; Sections 1 through 9," for potable domestic water piping and components.

Part 2 - Products

I. Piping Materials
   A. Transition Couplings: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
   B. Soft Copper Tube: ASTM B 88, Types K and L water tube, annealed temper.
      1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
      2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
      3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.
   C. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
      1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought- copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
      2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
      3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

II. Valves

A. Refer to Division 15 Section "Valves" for bronze and cast-iron, general-duty valves.

B. Refer to Division 15 Section "Plumbing Specialties" for balancing and drain valves.

Part 3 - Execution

I. Piping Applications

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground piping, unless otherwise indicated.

C. Domestic Water Piping: Use the following piping materials for each size range. Use copper unless plastic, PVC is specifically called for on the drawings:

1. 1-1/2" and Smaller: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
2. 2": Hard copper tube, Type L; copper pressure fittings; and soldered joints.
3. 2-1/2" to 3-1/2": Hard copper tube, Type L; copper pressure fittings; and soldered joints.
4. 4" to 6": Hard copper tube, Type L; copper pressure fittings; and soldered joints.

D. Nonpotable-Water Piping: Use the same piping materials as for Potable water:

II. Valve Applications

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use bronze ball or gate valves for piping 2" and smaller. Use cast-iron butterfly or gate valves with flanged ends for piping 2-1/2" and larger.
2. Throttling Duty: Use bronze ball or globe valves for piping 2" and smaller. Use cast-iron butterfly valves with flanged ends for piping 2-1/2" and larger.
3. Hot-Water-Piping, Balancing Duty: Memory-stop balancing valves.
4. Drain Duty: Hose-end drain valves.

III. Piping Installation

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation.

B. Extend domestic water service piping to exterior water distribution piping in sizes and locations indicated.

C. Install domestic water piping level and plumb unless indicated otherwise on the drawings for winter drainage.

D. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.

E. Perform the following steps before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
6. Remove filter cartridges from housings, and verify that cartridges are as specified for application where used and that cartridges are clean and ready for use.

F. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.

G. Check plumbing specialties and verify proper settings, adjustments, and operation.

1. Water-Pressure Regulators: Set outlet pressure at 80 psig maximum, unless otherwise indicated.

H. Energize pumps and verify proper operation.

IV. Joint Construction

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

V. Valve Installation

A. Install sectional valve close to water main on each branch and riser serving plumbing fixtures or equipment. Use ball or gate valves for piping 2” and smaller. Use butterfly or gate valves for piping 2-1/2” and larger.

B. Install shutoff valve on each water supply to equipment and on each water supply to plumbing fixtures without supply stops. Use ball or gate valves for piping 2” and smaller. Use butterfly or gate valves for piping 2-1/2” and larger.

C. Install drain valves for equipment, at base of each water riser, at low points in horizontal piping, and where required to drain water piping.

1. Install hose-end drain valves at low points in water mains, risers, and branches.
2. Install stop-and-waste drain valves where indicated.

D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping 2” and smaller and butterfly valves for piping 2-1/2” and larger. Refer to Division 15 Section "Plumbing Specialties" for balancing valves.

E. Where specified on the drawings, install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Refer to Division 15 Section "Plumbing Specialties" for calibrated balancing valves.

VI. Hanger And Support Installation

A. Refer to Division 15 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:

1. Vertical Piping: MSS Type 8 or Type 42 clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:
   a) 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b) Longer than 100 Feet MSS Type 43, adjustable roller hangers.
   c) Longer than 100 Feet if indicated: MSS Type 49, spring cushion rolls.
3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install supports according to Division 15 Section "Hangers and Supports."

C. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.

D. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. 1-1/4” NPS and Smaller: 84 inches with 3/8-inch rod.
2. 1-1/2” NPS: 108 inches with 3/8-inchrod.
3. 2” NPS: 10 feet with 3/8-inch rod.
4. 2-1/2”NPS: 11 feet with 1/2-inch rod.
5. 3” NPS and 3-1/2” NPS: 12 feet with 1/2-inch rod.
6. 4” NPS and 5” NPS: 12 feet with 5/8-inch rod.
7. 6”NPS: 12 feet with 3/4-inch rod.
8. 8” NPS to 12” NPS: 12 feet with 7/8-inch rod.

E. Install supports for vertical steel piping every 15 feet.

F. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. ¾” and Smaller: 60 inches with 3/8-inch rod.
2. 1” and 1-1/4”: 72 inches with 3/8-inch rod.
3. 1-1/2” and 2”: 96 inches with 3/8-inch rod.
4. 2-1/2” : 108 inches with 1/2-inch rod.
5. 3” to 5”: 10 feet with 1/2-inch rod.
6. 6” : 10 feet with 5/8-inch rod.
7. 8” : 10 feet with 3/4-inch rod.

G. Install supports for vertical copper tubing every 10 feet.

H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

VII. Connections

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to service piping with shutoff valve, and extend and connect to the following:

1. Booster Systems: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code.
4. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for 2-1/2” NPS and larger.

VIII. Field Quality Control

A. Inspect domestic water piping as follows:

1. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

a) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

b) Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test domestic water piping as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced domestic water piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
4. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

IX. Cleaning

A. Clean and disinfect potable and clean non-potable domestic water piping as follows:

1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:
   a) Flush piping system with clean, potable water until dirty water does not appear at outlets.
   b) Fill and isolate system according to either of the following:
   c) Fill potable system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
   d) Fill potable system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

e) Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.

f) Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION

Part 1 - General

I. Related Documents
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

II. Summary
   A. This Section includes the following plumbing specialties:
      1. Backflow preventers.
      2. Water regulators.
      3. Balancing valves.
      4. Water tempering valves.
      5. Strainers.
      6. Drain valves.
      7. Miscellaneous piping specialties.
      8. Sleeve penetration systems.
      9. Flashing materials.
   B. Related Sections include the following:
      1. Division 15 Section "Meters and Gages" for water meters, thermometers, and pressure gages.

III. Definitions
   A. The following are industry abbreviations for plastic piping materials:
      1. ABS: Acrylonitrile-butadiene-styrene plastic.
      2. PE: Polyethylene plastic.
      3. PUR: Polyurethane plastic.
      4. PVC: Polyvinyl chloride plastic.

IV. Performance Requirements
   A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:
      1. Domestic Water Piping: 125 psig.

V. Submittals
   A. Product Data: Include rated capacities and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following:

1. Backflow preventers and water regulators.
2. Balancing valves, water filters, and strainers.
3. Thermostatic water mixing valves and water tempering valves.
4. Drain valves, hose bibbs, hydrants, and hose stations.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field test reports.

D. Maintenance Data: For plumbing specialties to include in maintenance manuals. Include the following:

1. Backflow preventers and water regulators.
2. Thermostatic water mixing valves and water tempering valves.

VI. Quality Assurance

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of plumbing specialties and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

B. Plumbing specialties shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for piping materials and installation.

E. NSF Compliance:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components. Include marking "NSF-pw" on plastic potable-water piping and "NSF-dwv" on plastic drain, waste, and vent piping.
2. Comply with NSF 61, "Drinking Water System Components--Health Effects, Sections 1 through 9," for potable domestic water plumbing specialties.

Part 2 - Products

I. Manufacturers

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

II. Backflow Preventers

A. Approved Manufacturers:

1. Ames Co., Inc.
2. B & K Industries, Inc.
3. Cla-Val Co.
4. CMB Industries, Inc.; Febco Backflow Preventers.
5. Conbraco Industries, Inc.
6. FLOMATIC Corp.
7. IMI Cash Valve.
8. Mueller Co.; Hersey Meters Div.
9. Sparco, Inc.
10. Watts Industries, Inc.; Water Products Div.
11. Zurn Industries, Inc.; Wilkins Div.

B. General: ASSE standard, backflow preventers.

1. 2” NPS and Smaller: Bronze body with threaded ends.
2. 2-1/2” NPS and Larger: Bronze, cast-iron, steel, or stainless-steel body with flanged ends.
   a) Interior Lining: AWWA C550 or FDA-approved, epoxy coating for backflow preventers having cast-iron or steel body.
3. Interior Components: Corrosion-resistant materials.
4. Exterior Finish: Polished chrome plate if used in chrome-plated piping system.
5. Strainer: On inlet, if indicated.

C. Pipe-Applied, Atmospheric-Type Vacuum Breakers: ASSE 1001, with floating disc and atmospheric vent.

D. Hose-Connection Vacuum Breakers: ASSE 1011, nickel plated, with nonremovable and manual drain features, and ASME B1.20.7, garden-hose threads on outlet. Units attached to rough-bronze-finish hose connections may be rough bronze.

E. Intermediate Atmospheric-Vent Backflow Preventers: ASSE 1012, suitable for continuous pressure application. Include inlet screen and two independent check valves with intermediate atmospheric vent.

F. Reduced-Pressure-Principle Backflow Preventers: ASSE 1013, suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet; test cocks; and pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between two positive-seating check valves.

1. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.

G. Double-Check Backflow Prevention Assemblies: ASSE 1015, suitable for continuous pressure application. Include shutoff valves on inlet and outlet, and strainer on inlet; test cocks; and two positive-seating check valves.

1. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.

H. Antisiphon-Pressure-Type Vacuum Breakers: ASSE 1020, suitable for continuous pressure application. Include shutoff valves, spring-loaded check valve, spring-loaded floating disc, test cocks, and atmospheric vent.

1. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.

I. Dual-Check-Valve-Type Backflow Preventers: ASSE 1024, suitable for continuous pressure application. Include union inlet and two independent check valves.

J. Dual-Check-Valve-Type Backflow Preventers: ASSE 1032, suitable for continuous pressure application for carbonated beverage dispensers. Include stainless-steel body; primary and secondary checks; ball check; intermediate atmospheric-vent port for relieving carbon dioxide; and threaded ends, 3/8” NPS.

K. Reduced-Pressure Detector Assembly Backflow Preventers: ASSE 1047, FM approved or UL listed, and suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet. Include test cocks; pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between two positive-seating check valves; and bypass with displacement-type water meter, valves, and reduced-pressure backflow preventer.

1. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.

L. Double-Check Detector Assembly Backflow Preventers: ASSE 1048, FM approved or UL listed, and suitable for continuous pressure application. Include outside screw and yoke

gate valves on inlet and outlet, and strainer on inlet. Include test cocks; two positive-seating check valves; and bypass with displacement-type water meter, valves, and double-check backflow preventer.

1. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.

M. Back-Siphonage Backflow Vacuum Breakers: ASSE 1056, suitable for continuous pressure and backflow applications. Include shutoff valves, check valve, test cocks, and vacuum vent.

III. Water Regulators

A. Approved Manufacturers:

1. Armstrong-Yoshitake, Inc.
2. BERMAD.
3. Cashco, Inc.
4. Cla-Val Co.
5. Conbraco Industries, Inc.
6. FLOMATIC Corp.
7. G A Industries, Inc.
8. Honeywell Braukmann.
9. IMI Cash Valve.
10. Watts Industries, Inc.; Water Products Div.
11. Zurn Industries, Inc.; Wilkins Div.

B. General: ASSE 1003, water regulators, rated for initial working pressure of 150 psig minimum. Include integral factory-installed or separate field-installed, Y-pattern strainer.

1. 2” NPS and Smaller: Bronze body with threaded ends.
   a) General-Duty Service: Single-seated, direct operated, unless otherwise indicated.
   b) Booster Heater Water Supply: Single-seated, direct operated with integral bypass.
2. 2-1/2” NPS and Larger: Bronze or cast-iron body with flanged ends. Include AWWA C550 or FDA-approved, interior epoxy coating for regulators with cast-iron body.
   a) Type: Single-seated, direct operated.
   b) Type: Pilot-operated, single- or double-seated, cast-iron-body main valve, with bronze-body pilot valve.
3. Interior Components: Corrosion-resistant materials.

4. Exterior Finish: Polished chrome plate if used in chrome-plated piping system.

IV. Water Tempering Valves

A. Approved Manufacturers:

1. Heat-Timer Corporation.
2. Holby Valve Co., Inc.
3. Sparco, Inc.
4. Watts Industries, Inc.; Water Products Div.
5. Approved Equal.

B. General: Manually adjustable, thermostatically controlled water tempering valve; bronze body; and adjustable temperature setting.

C. System Water Tempering Valves: Piston or discs controlling both hot- and cold-water flow, capable of limited antiscald protection. Include threaded inlets and outlet.

1. Finish: Rough bronze.

D. Limited-Volume, Water Tempering Valves: Solder-joint inlets and ¾"NPS maximum outlet.

V. Strainers

A. Strainers: Y-pattern, unless otherwise indicated, and full size of connecting piping. Include ASTM A 666, Type 304, stainless-steel screens with 3/64-inch round perforations, unless otherwise indicated.

1. Pressure Rating: 125-psig minimum steam working pressure, unless otherwise indicated.
2. 2" NPS and Smaller: Bronze body, with female threaded ends.
3. 2-1/2" NPS and Larger: Cast-iron body, with interior AWWA C550 or FDA-approved, epoxy coating and flanged ends.
4. Y-Pattern Strainers: Screwed screen retainer with centered blowdown.
   a) Drain**:** Pipe plug.
5. T-Pattern Strainers: Malleable-iron or ductile-iron body with grooved ends; access end cap with drain plug and access coupling with rubber gasket.
6. Basket Strainers: Bolted flange or clamp cover, and basket with lift-out handle.
   a) Type: Duplex with bronze or stainless-steel diverter valve and two baskets.
   b) Drain: Factory- or field-installed, hose-end drain valve.

VI. Drain Valves

A. Hose-End Drain Valves: MSS SP-110, ¾"NPS ball valve, rated for 400-psig minimum CWP. Include two-piece, copper-alloy body with standard port, chrome-plated brass ball, replaceable seats and seals, blowout-proof stem, and vinyl-covered steel handle.
   1. Inlet: Threaded or solder joint.
   2. Outlet: Short-threaded nipple with ASME B1.20.7, garden-hose threads and cap.

B. Stop-and-Waste Drain Valves: MSS SP-110, ball valve, rated for 200-psig minimum CWP or MSS SP-80, Class 125, gate valve; ASTM B 62 bronze body, with 1/8" side drain outlet and cap.

VII. Miscellaneous Piping Specialties

A. Hose Bibbs: Bronze body with replaceable seat disc complying with ASME A112.18.1M for compression-type faucets. Include ½" or ¾" threaded or solder-joint inlet, of design suitable for pressure of at least 125 psig; integral or field-installed, nonremovable, drainable hose-connection vacuum breaker; and garden-hose threads complying with ASME B1.20.7 on outlet.
   1. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
   2. Operation for Equipment Rooms: Wheel handle or operating key.
   3. Operation for Service Areas: Wheel handle.

B. Air Vents: Float type for automatic air venting.
   1. Bolted Construction: Bronze body with replaceable, corrosion-resistant metal float and stainless-steel mechanism and seat; threaded 3/8" NPS minimum inlet; 125-psig minimum pressure rating at 140 deg F; and threaded vent outlet.

C. Roof Flashing Assemblies: Manufactured assembly made of minimum 4-lb/sq. ft., 0.0625-inch- thick, lead flashing collar and skirt extending at least 8 inches from pipe with galvanized steel boot reinforcement, and counterflashing fitting.
   1. Approved Manufacturers:
      a) Acorn Engineering Company; Elmdor/Stoneman Div.
      b) Approved Equal.
   2. Open-Top Vent Cap: Without cap.
   3. Low-Silhouette Vent Cap: With vandal-proof vent cap.
   4. Extended Vent Cap: With field-installed, vandal-proof vent cap.

D. Fixed Air-Gap Fittings: Manufactured cast-iron or bronze drainage fitting with semiopen top with threads or device to secure drainage inlet piping in top and bottom spigot or threaded outlet larger than top inlet. Include design complying with ASME A112.1.2 that will provide fixed air gap between installed inlet and outlet piping.

Part 3 - Execution

I. Installation

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
3. Do not install bypass piping around backflow preventers.

C. Install pressure regulators with inlet and outlet shutoff valves and balance valve bypass. Install pressure gages on inlet and outlet.

D. Install strainers on supply side of each control valve, pressure regulator, and solenoid valve.

E. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.

F. Fasten recessed-type plumbing specialties to reinforcement built into walls.

G. Install individual shutoff valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve is not indicated. Install shutoff valves in accessible locations. Refer to Division 15 Section "Valves" for general-duty ball, butterfly, check, gate, and globe valves.

H. Install air vents at piping high points. Include ball, gate, or globe valve in inlet.

I. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

II. Connections

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Connect plumbing specialties to piping specified in other Division 15 Sections.

D. Ground equipment.

E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

F. Connect plumbing specialties and devices that require power according to Division 16 Sections.

III. Labeling And Identifying

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each backflow preventer and water tempering valve.

1. Text: Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.
2. Refer to Division 15 Section "Mechanical Identification" for nameplates and signs.

IV. Field Quality Control

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled trap seal primer systems and their installation, including piping and electrical connections. Report results in writing.

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

V. Protection

A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

VI. Demonstration

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain trap seal primer systems and interceptors.

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 - General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope
   A. Provide and install the domestic recirculating pump as shown on the drawings and specified herein.

III. Quality Assurance
   A. Pump must be selected from published test curves showing actual brake horsepower. The selection point shall be confined to the left of center of the efficiency curve for the impeller being furnished.
   B. All pump motors shall meet NEMA Standards and shall be U/L listed.
   C. All pumps shall be factory tested prior to shipment to the job site.

IV. Submittals
   A. Provide shop drawings on this equipment as described in Section 230100 - 1.04.

Part 2 - Products

I. Domestic Recirculating Pump
   A. The domestic recirculating pump shall be of the centrifugal inline mounted type and of the size, capacity and voltage shown on the drawings. Acceptable manufacturers shall include:
      1. Bell & Gossett
      2. Armstrong
      3. Weinmann
      4. Patterson.
   B. Pump - Shall be quiet operating, horizontal, oil lubricated, inline, single stage, vertical split case design, and shall be all-bronze construction for domestic water applications. The pump internals shall be capable of being serviced without disturbing piping connections. The pump shall have a dynamically balanced impeller keyed and locknutted to a ground and polished steel shaft with hardened integral thrust collar. Shaft shall be supported by

oil lubricated bronze sleeve bearings. Water tight mechanical seal faces shall be carbon on cast iron or ceramic.

C. Coupling - Shall be self aligning, flexible type connecting the pump and motor.

D. Motor - Shall be open drip proof, journal bearing, resilient mounted, 1750 rpm, and shall be especially selected for quiet operation. The electrical characteristics of the motor shall be as shown on the drawings. The horsepower of the motor shall be of such a size as to insure non-overloading of the motor throughout the capacity range of the pump. The motor shall have sealed bearings.

E. Testing - The pump shall be factory tested, thoroughly cleaned, and painted with one (1) coat of machinery enamel prior to shipment. A set of installation instructions shall be included with the pump at the time of shipment.

F. Starter - Provide a manual starter for single phase units and magnetic across-the-line starter for three phase units. The starter shall have HAND-OFF-AUTOMATIC switch and red running light. See Section 15050 paragraph 2.07.

II. Specialties

A. Specialties shall be provided for all pumps, which shall include, but not be limited to, isolation valves, unions, thermometers, and check valves.

Part 3 - Execution

I. Installation

A. The pump shall be installed and serviced in accordance with the manufacturer's recommendations and as shown on the drawings.

B. Coupling guards shall be installed per ANSI and OSHA standards.

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 -General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope
   A. Provide and install the inline pump as shown on the drawings and specified herein.

III. Quality Assurance
   A. Pump must be selected from published test curves showing actual brake horsepower. The selection point shall be confined to the left of center of the efficiency curve for the impeller being furnished.
   B. All pump motors shall meet NEMA Standards and shall be UL listed.
   C. All pumps shall be factory tested prior to shipment to the job site.

IV. Submittals
   A. Provide shop drawings on this equipment as described in Section 230100 - 1.04.

Part 2 - Products

I. Inline Pump
   A. The inline pump shall be of the centrifugal inline mounted type and of the size, capacity and voltage shown on the drawings. Acceptable manufacturers include:
      1. Bell & Gossett
      2. Armstrong
      3. Weinmann
      4. Patterson.
   B. Pump - Shall be quiet operating, horizontal, oil lubricated, inline, single stage, vertical split case design, in cast iron bronze fitted construction for heating or cooling applications and shall be all bronze construction for domestic water applications. The pump internals shall be capable of being serviced without disturbing piping connections. The pump shall have a dynamically balanced impeller keyed and locknutted to a ground and polished steel shaft with hardened integral thrust collar. Shaft shall be supported by oil lubricated bronze sleeve bearings. Watertight mechanical seal faces shall be carbon on cast iron or ceramic.

C. Coupling - Shall be self-aligning, flexible type connecting the pump and motor.

D. Motor - Shall be open drip proof, journal bearing, resilient mounted, 1750 rpm, and shall be especially selected for quiet operation. The electrical characteristics of the motor shall be as shown on the drawings. The horsepower of the motor shall be of such a size as to insure non-overloading of the motor throughout the capacity range of the pump. The motor shall have sealed bearings.

E. Testing - The pump shall be factory tested, thoroughly cleaned, and painted with one (1) coat of machinery enamel prior to shipment. A set of installation instructions shall be included with the pump at the time of shipment.

F. Starter - Provide a manual starter for single-phase units and magnetic across-the-line starter for three phase units. The starter shall have HAND-OFF-AUTOMATIC switch and red running light. See Section 230500 paragraph 2.07.

II. Specialties

A. Specialties shall be provided for all inline pumps, which shall include, but not be limited to, isolation valves, unions, strainers, thermometers and check valves.

Part 3 - Execution

I. Installation

A. The pumps shall be installed and serviced in accordance with the manufacturer's recommendations and as shown on the drawings.

B. Coupling guards shall be installed per ANSI and OSHA standards.

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 -General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope
   A. The work covered under this section shall include a complete soil, waste and vent system.

III. Quality Assurance
   A. The entire system shall be tested and approved as required by the plumbing code and local requirements before the system is covered up.

IV. Submittals
   A. Provide shop drawings on all piping and fittings as described in Section 230100 - 1.04.

Part 2 - Products

I. Pipe And Fittings
   A. Soil and Waste Pipe and Fittings Below Grade: Shall be service weight cast iron bell-and-spigot pipe and fittings or schedule 40 PVC plastic pipe and PVC-DWV fittings. PVC flanges with metal rings below grade are not acceptable.
   B. Soil, Waste and Vent Pipe and Fittings Above Grade: Shall be service weight cast iron bell-and-spigot pipe and fittings, schedule 40 galvanized steel pipe with screwed cast iron drainage pattern fittings, cast iron no-hub piping and fitting or schedule 40 PVC plastic pipe and PVC-DWV fittings except as noted in paragraph 'C'. PVC plastic piping shall not be used in plenum spaces. DWV copper tubing and copper drainage pattern fittings shall be used for piping at the 3-compartment sink. All piping between the science prep room sinks and the acid neutralization basin shall be acid resistant polypropylene pipe and fittings.
   C. Soil, Waste and Vent Stacks - shall be cast iron bell and spigot pipe and fittings or cast iron no-hub.

II. Vent Flashings

A. Vent flashings shall be 3 lb. per square foot lead flashings or 2 1/2 lb. per square foot for prefabricated flashings, except on roofs where the manufacturer of the roof requires a special flashing to tie in his roofing system.

Part 3 - Execution

I. Pipe And Fittings

A. All soil and waste piping shall be run at a minimum grade of 1/4" per foot unless otherwise noted on the drawings. The contractor shall field check all proposed soil and waste piping to verify that the piping system can be installed at the required grade before any soil and waste piping is installed.

B. When the Building Sewer piping is installed using non-metallic piping, an insulated tracer wire, 18 AWG minimum in size and suitable for direct burial shall be installed in the same trench as the sewer within 12 inches of the pipe, this tracer wire shall terminate at the cleanout access cover.

C. All openings in the piping system during construction shall be securely capped to prevent foreign matter from entering the piping system.

D. Piping to cleanouts shall be as shown on the drawings and as required by the local plumbing code.

E. The minimum depth of the building sewer shall be no less than two feet below finished grade.

F. Double sanitary tee fittings shall not be allowed for piping receiving the discharge from fixtures or appliances.

G. PVC flanges shall not be allowed for water closets or urinals.

H. Copper pipe and fittings shall not be used on waste piping for urinals.

II. Vents And Vent Flashings

A. Vent pipes shall extend 12" above the roof unless otherwise required. The minimum size vent through roof shall be 2".

B. The lead vent flashings shall be turned down on the inside of the vent. On roofing systems where the roofing manufacturer requires a special flashing, the contractor shall install flashing as required.

C. Vent piping shall not terminate within ten feet of outside air intake. Coordinate with International Mechanical Code.

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 - General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope
   A. The work covered under this section shall include a complete roof drainage system.

III. Quality Assurance
   A. The roof drainage system shall be tested for leaks before the insulation is applied and before the piping is covered up. The test shall be filling the system with water.

IV. Submittals
   A. Provide shop drawings on all piping and fittings as described in Section 230100 - 1.04.

Part 2 - Products

I. Pipe And Fittings
   A. Storm Water Piping Below Grade: Shall be service weight cast iron bell-and-spigot pipe and fittings or schedule 40 PVC plastic pipe and PVC-DWV fittings.
   B. Storm Water Piping Above Grade: Shall be service weight cast iron bell-and-spigot pipe and fittings, cast iron no-hub piping and fittings, schedule 40 galvanized steel pipe with screwed cast iron drainage pattern fittings, or schedule 40 PVC plastic pipe and PVC fittings. PVC plastic piping shall not be used in plenum spaces.
   C. Storm water piping below grade from 5 feet outside of the building to the storm water structure may be reinforced concrete bell-and-spigot pipe with precast matching fittings.

II. Roof Drains And Cleanouts
   A. Roof drains and cleanouts shall be as listed under section 15430.

Part 3 - Execution

I. Pipe And Fittings
   A. All piping shall be run at a minimum grade of 1/4" per foot unless otherwise noted on the drawings. The contractor shall field check all proposed storm water piping to verify that the piping system can be installed at the required grade before any piping is installed.

B. All openings in the piping system during construction shall be securely capped to prevent foreign matter from entering the piping system.

C. Piping to cleanouts shall be as shown on the drawings and as required by the local plumbing code.

D. The piping to the roof drains shall have a minimum of 5 feet offset between the vertical rain leader and the riser to the drain for expansion unless otherwise noted.

E. The minimum depth of the building storm sewer shall be no less than two feet below finished grade.

II. Pipe Insulation

A. The horizontal section of the rain leaders, riser to and including the interior part of the roof drain, shall be insulated to prevent condensation. Pipe insulation shall be as listed under section 15250.

III. Roof Drains

A. The roof drains and accessories shall be installed to meet the requirements of the roofing system. The roof drains shall be flashed with a 4-foot square sheet of 4-lb. lead. On roofing systems where the roofing manufacturing requires a special flashing, the contractor shall install the flashing as required.

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 -General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope
   A. The extent of compressed air piping work and auxiliary equipment is indicated by drawings and schedules and by requirements of this section, and is hereby defined to include (but not necessarily be limited to) air compressor, receiver, air dryer, belt guard, all required air piping, needle valves, automatic tank drain and outlets as indicated and as specified. Provide blow-off valves at low points and intake filter silencer on exterior of building, piped to compressor.

III. Quality Assurance
   A. ANSI Code Compliance - Comply with applicable provisions of ANSI B 31.1, “Power Piping.”
   B. ASME Code Symbol Stamps - Provide compressed air receivers and safety (pressure relief) valves complying with applicable ASME codes, and stamped with appropriate code symbols.
   C. CGA Standards - Materials shall comply with Compressed Gas Association standards.
   D. UL Labels - Provide electrical components which have been listed and labeled by Underwriters Laboratories.

IV. Submittals
   A. Provide shop drawings on all equipment as described in Section 230100 - 1.04.

Part 2 - Products

I. Compressed Air Piping
   A. Piping shall be galvanized schedule 40 steel pipe with galvanized screwed, 150 pound type fittings.
   B. Air Pressure Reducing Valve - Bronze body, sized for capacity of system and set for 125 psi outlet pressure.
   C. Pressure Gauges – 2” minimum dial with safety blowout brass gauge cock.

D. Couplings - Provide Hansen quick connect-disconnect couplings. Type shall be suitable for use with Owner's equipment.

E. Valves - Safety relief valve shall be 2 piece, full-port, chrome plated ball valve rated for 125 psi operating pressure.

II. Air Compressor

A. General - Furnish and install a self-contained compressor unit, consisting of a compressor, motor, V-belt drive, and pressure regulator, all mounted on a vertical ASME receiver. Suitable interconnecting piping between the compressor, receiver and pressure regulator shall be included.

B. Performance - The compressor shall deliver not less than the scheduled cubic feet of free air per minute at inlet conditions compressed to the indicated pressure. Inlet conditions of 14.7 psia and ambient temperature of 90°F. Provide the Owner with a copy of the test/start-up record.

C. The Tech Lab air compressor shall deliver 10.9 ACFM free air delivered at 125 PSIG, 80 gallon ASME receiver, 3 HP V(select) PH(select) 60HZ. Options shall include; ASME pressure relief valve, automatic tank drain, stop-start control, belt guard, low oil control, starting unloader, and intake filter silencer. Provide phase protector as required in section 15050.

D. Receiver shall be built in accordance with ASME "Unfired Pressure Vessel Code" for a working pressure of 150 PSI, and shall be stamped with official ASME symbol, name of manufacturer, maximum allowable working pressure, year built, and National Board Number. Provide an ASME approved safety valve set to relieve at a pressure not in excess of working pressure of receiver. Valve shall be installed directly in receiver. Receiver shall be provided with a pressure gauge having not less than 2" dial graduated to not less than 1½ times maximum operating pressure. Gauge shall be installed on, or connected directly to receiver.

E. Compressor and receiver shall be installed on a concrete foundation not less than 4" high, having vibration isolation pads.

F. Automatic Condensate Trap - Automatic condensate trap shall be provided to remove accumulated moisture from the discharge receiver and aftercooler.

Part 3 - Execution

I. Installation

A. General - Comply with requirements of section 230100 for installation of basic piping materials. Install compressed air piping products and equipment in accordance with manufacturer's written instructions, applicable requirements of ANSI B 31.1, and in accordance with recognized industry practices.

B. The manufacturer shall provide the services of a qualified representative to review the installation of the compressors and all components, test and start the compressors, and instruct the Owner's operating personnel in the operation and maintenance of the systems.

C. Extend compressed air lines from receiver to rooms and outlets indicated on the drawing and connect to all equipment requiring compressed air.

D. Pitch piping in direction of flow and provide drip pockets and nipples at low points. Provide stopcocks and unions to permit disconnection at equipment.

II. Pipe Test

A. Compressed Air Piping Leak Test - Prior to initial operation of piping system, purge lines with oil-free air, and perform a 24-hour standing pressure time-test. Charge line with compressed air to 150 psi; maintain test pressure for 24 hours with a pressure loss no greater than 5 psi. During pressure test, test joints and fittings for leaks with soap bubble solution.

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 -General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods shall apply to this section.

II. Scope
   A. The work covered under this section shall include providing and installing complete electric water heaters.

III. Quality Assurance
   A. The water heater shall meet the requirements of the current ASHRAE Standard 90.1, for energy conservation.
   B. The electric water heater shall be factory wired in accordance with the National Electrical Code, and the heater shall bear the UL label.
   C. The water heater shall be tested at a pressure of 300 psi and shall have a water working pressure of 150 psi.
   D. The water heater shall be installed as recommended by the manufacturer and local codes.
   E. The water heater installation shall include the start-up and check out procedures as recommended by the manufacturer. Provide the owner with a copy of the start-up record.

IV. Submittals
   A. Provide shop drawings on this equipment, including an installation diagram, as described in Section 230100, 1.04.

Part 2 - Products

I. Electric Water Heaters
   A. The size, type and capacity of the water heaters are shown on the drawings along with the specified manufacturer. Water heaters shall be fully equal to the water heater specified on the drawings. Acceptable manufacturers include:
      1. Ruud/Rheem
      2. A. O. Smith
      3. State
      4. Lochinvar

B. Tank - The steel tank shall be glass lined with magnesium anode to resist corrosion, unless otherwise noted on the drawings. The tank shall be insulated to meet the current ASHRAE 90.1 requirements and shall be covered with baked enamel paint.

C. Heating Element - The heating element shall be the low watt density and screw-in design. The voltage shall be as shown on the drawings and shall be stamped on the water heater.

D. Controls

1. The water heater shall have an adjustable thermostat for operating control. The adjustable thermostat shall maintain the correct water temperature as stated on the drawings or required by Code.
2. The water heater shall have a high limit or over temperature control to cut off the power in excess temperature situations.

II. Pressure And Temperature Relief Valve

A. The combination pressure and temperature relief valve for water heater(s) shall be rated equal to or greater than the maximum hourly heat input rate of the water heater. Each relief valve shall be ASME listed, rated and stamped. Pressure relief setting shall be 150 psi or less and temperature relief of 210 degrees F, all bronze body with stainless steel spring, test level and mounted to monitor the temperature within 6" of the tank.

III. Expansion Tank

A. Shall be ASME labeled and size listed on the drawings. Provide the tank with the required tappings and a prime coat of paint. Acceptable manufacturers include:

1. Bell & Gossett
2. Taco
3. John Wood
4. Wessels
5. Armstrong.

Part 3 - Execution

I. Installation

A. The water heater shall be installed as shown on the drawings in an accessible location. Gate valves shall be installed on both the cold water supply pipe and the hot water pipe. A vacuum relief shall be installed on the cold water pipe between the gate valve and tank, and shall be located above the top of the tank. A thermometer shall be installed in the hot

water pipe above the top of the heater. All valves shall be mounted so as to be accessible while standing on the floor.

B. Where water heaters are mounted above the floor, provide and install a shelf to carry the water heater. The shelf shall have the capability of carrying the water heater filled with water.

C. A drip pan, where shown on the drawings or required by Code, shall be provided and installed. The drip pan shall be of a size to accommodate the water heater. The drip pan shall be fabricated with a minimum of 22 gauge galvanized steel. The drip pan shall be piped full size to a receptor.

D. The relief valve shall be piped full size to a receptor.

E. The thermostats in the water heater shall be adjusted to produce the water temperature called for on the drawings.

F. The water heater instruction booklet shall be secured to the water heater.

G. Provide a spare fuse for the water heater.

H. Provide ASME rated expansion tank. Install as recommended by manufacturer.

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 -General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope
   A. The work covered under this section shall include providing and installing complete the forced draft gas water heater as shown on the drawings.

III. Quality Assurance
   A. The gas water heater shall conform with NFPA 54 - Natural Fuel Gas Code Requirements.
   B. The gas water heater shall conform with the current International Fuel Gas Code.
   C. The water heater shall meet the requirements of the current ASHRAE Standard 90.1, for energy conservation.
   D. The gas water heater shall bear the AGA label.
   E. The water heater shall be tested at a pressure of 300 psi and shall have a water working pressure of 150 psi.
   F. Water heaters with an AGA rating of 200,000 BTU/hr input or greater shall be ASME constructed and bear the UL label.
   G. Water heaters with an AGA rating of 300,000 BTU/HR input or greater shall have the manufacturers IRI rated gas train assembly installed.
   H. The water heater shall be installed as recommended by the manufacturer and local codes.
   I. The water heater installation shall include the start-up and check out procedures as recommended by the manufacturer. Provide the owner with a copy of the start-up record.

IV. Submittals
   A. Provide shop drawings on this equipment, including an installation diagram, as described in section 230100, 1.04.

Part 2 - Products

I. Gas Water Heater

A. The rating, type and capacity of the water heater are shown on the drawings along with the specified manufacturer. Water heaters shall be fully equal to the water heater specified on the drawings. Acceptable manufacturers include:
   1. Rheem/Ruud
   2. A. O. Smith
   3. PVI
   4. RBI
   5. State
   6. Lochinvar.

B. Tank - the steel tank shall be glass lined with magnesium anode to resist corrosion unless otherwise noted on the drawings. The tank shall be insulated to meet the current ASHRAE Standard 90.1 requirements and shall be covered with a baked enamel jacket.

C. The contractor shall totally regulate the gas supply to main and pilot burners. The heater shall also be equipped with an automatic gas shut off device to shut off entire gas supply in the event of excessive temperature in tank and pilot safety shut off. The gas controls shall have an adjustable temperature setting to deliver hot water at the temperature called for on the drawings.

II. Pressure And Temperature Relief Valve

A. The combination pressure and temperature relief valve for the water heater(s) shall be rated equal to or greater than the maximum hourly heat input rate of the water heater. Each relief valve shall be ASME listed, rated and stamped. Pressure relief setting shall be 150 psi or less and temperature relief of 210 degrees F, all bronze body with stainless steel spring, test level and mounted to monitor the temperature within 6" of the tank. A thermometer shall be installed in the hot water pipe above the top of the tank.

III. Expansion Tank shall be ASME labeled and size listed on the drawings. Provide the tank with the required tappings and a prime coat of paint. Acceptable manufacturers include:

A. Bell & Gossett
B. Taco
C. John Wood
D. Wessels
E. Armstrong
F. RBI.

Part 3 - Execution

I. Installation

A. Gas Water Heater - The water heater shall be installed as shown on the drawings in an accessible location. Gate valves shall be installed on both the cold water supply pipe and the hot water pipe. A vacuum relief shall be installed on the cold water pipe between the gate valve and tank, and shall be located above the top of the tank. A thermometer shall be installed in the hot water pipe above the top of the tank. All valves shall be mounted so as to be accessible while standing on the floor.

B. Piping - The relief valve shall be piped full size to a receptor or to the floor.

C. Thermostats - The thermostats in the water heater shall be adjusted to produce the water temperature called for on the drawings.

D. Instructions - The water heater instruction booklet shall be secured to the water heater.

E. Provide a spare fuse for the water heater.

F. Provide ASME rated expansion tank. Install as recommended by manufacturer.

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 -General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods shall apply to this section.

II. Scope
   A. The work covered under this section shall include providing and installing complete the forced draft gas water heater as shown on the drawings.

III. Quality Assurance
   A. The gas water heater shall conform with NFPA 54 - Natural Fuel Gas Code Requirements.
   B. The gas water heater shall conform with the current International Fuel Gas Code
   C. The water heater shall meet the requirements of the current ASHRAE Standard 90.1, for energy conservation.
   D. The gas water heater shall bear the AGA or CSA label.
   E. The water heater shall be tested at a pressure of 225 psi and shall have a water working pressure of 150 psi.
   F. Water heaters with an AGA rating of 200,000 BTU/hr input or greater shall be ASME constructed and bear the UL label.
   G. Water heaters with an AGA rating of 300,000 BTU/HR input or greater shall have the manufacturer's GE-GAP (IRI) /CSD-1 rated gas train assembly installed.
   H. The water heater shall be installed as recommended by the manufacturer and local codes.
   I. The water heater installation shall include factory start-up. Start up on the unit shall be performed by factory trained and authorized personnel. Provide the Owner with a copy of the start-up record.

IV. Submittals
   A. Provide shop drawings on this equipment, including an installation diagram, as described in Section 230100, 1.04.

Part 2 - Products

I. Condensing Gas Water Heater

A. The rating, type and capacity of the water heater are shown on the drawings along with the specified manufacturer. Water heaters shall be fully equal to the water heater specified on the drawings. Acceptable manufacturers include:
   1. Bock
   2. A. O. Smith
   3. State
   4. Lochinvar.

B. Tank - The steel tank shall be glass lined or an unlined pressure vessel constructed from phase-balanced austenitic and ferritic duplex stainless steel. The storage tank, heating surfaces and combustion chamber shall have a full 5 year warranty covering manufacturing or material defects, leaks and/or the production of rusty water. The tank shall be insulated to meet the current ASHRAE Standard 90.1 requirements.

C. Water heaters with full rated input below 600,000 BTU will operate at a minimum 96% thermal efficiency at full firing rate when tested to the ANSI Z21.10.3 thermal efficiency test protocol (DOE 10 CFR 431). Water heaters with full rated input above 600,000 BTU will operate at a minimum 94% thermal efficiency at full firing rate when tested to the ANSI Z21.10.3 thermal efficiency test protocol (DOE 10 CFR 431). The water heater shall be ETL listed as a complete unit. The heater shall satisfy current Federal Energy Policy Act standards for both thermal efficiency and stand-by heat losses as established for gas fired water heaters.

D. The water heater shall be a vertical fire tube, design that is constructed and stamped in accordance with Section IV, Part HLW of the ASME code. Water heater will be National Board Registered for a working pressure of 150 psi and will be pressure tested at 1-1/2 times working pressure. Materials shall meet ASME Section II material requirements and be accepted by NSF 61 for municipal potable water systems. All tank connections/fittings shall be nonferrous or stainless steel. The water heater shall employ an electronic operating control with digital temperature readout. Operator shall be capable of connecting to a building automation system through serial connection using Modbus RTU protocol. At a minimum, the water heater shall be equipped with the following:
   1. Electronic flame monitoring.
   2. An immersion operating control.
   3. An immersion UL listed temperature limiting device.

E. The Contractor shall totally regulate the gas supply to main and pilot burners. The heater shall also be equipped with an automatic gas shut off device to shut off the entire gas

supply in the event of excessive temperature in tank and pilot safety shut off. The gas controls shall have an adjustable temperature setting to deliver hot water at the temperature called for on the drawings.

II. Pressure And Temperature Relief Valve

A. The combination pressure and temperature relief valve for the water heater(s) shall be rated equal to or greater than the maximum hourly heat input rate of the water heater. Each relief valve shall be ASME listed, rated and stamped. Pressure relief setting shall be 150 psi or less and temperature relief of 210 degrees F, all bronze body with stainless steel spring, test level and mounted to monitor the temperature within 6" of the tank. A thermometer shall be installed in the hot water pipe above the top of the tank.

III. Expansion Tank

A. Shall be ASME labeled and the size listed on the drawings. Provide the tank with the * required tappings and a prime coat of paint. Acceptable manufacturers include:

1. Bell & Gossett
2. Taco
3. John Wood
4. Wessels
5. Armstrong.

Part 3 - Execution

I. Installation

A. Condensing Gas Water Heater - The water heater shall be installed as shown on the drawings in an accessible location. Gate valves shall be installed on both the cold water supply pipe and the hot water pipe. A vacuum relief shall be installed on the cold water pipe between the gate valve and tank, and shall be located above the top of the tank. A thermometer shall be installed in the hot water pipe above the top of the tank. All valves shall be mounted so as to be accessible while standing on the floor. Start up on the water heater shall be performed by factory trained and authorized personnel. A copy of the start up report shall be provided to the Owner.

B. Piping - The relief valve shall be piped full size to a receptor or to the floor.

C. Thermostats - The thermostats in the water heater shall be adjusted to produce the water temperature called for on the drawings.

D. Instructions - The water heater instruction booklet shall be secured to the water heater.

E. Provide a spare fuse for the water heater.

F. Provide an ASME rated expansion tank. Install as recommended by manufacturer.

END OF SECTION

SECTION 23 0100
MECHANICAL GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 GENERAL

A. The Bidding and Contract Requirements and Division 1 - General Requirements for the Construction of this project shall apply to this division and all sections herein. Section Includes: General requirements for mechanical items and systems.

B. Where items under the Bidding and Contract Requirements, and Division 1 - General Requirements are repeated in this section, it is intended to call particular attention to or qualify the items. It is not intended that any other parts under the Bidding and Contract Requirements of Division 1 - General Requirements shall be assumed to be omitted if not repeated herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE (NON-INCLUSIVE)

A. The work included under this Division shall include a complete mechanical system as shown on the drawings and as specified herein. Any apparatus, appliance, material or work not shown on the drawings but mentioned in the specifications, or vice versa, or any incidental accessories necessary to make the work complete in all respects and ready for operation, even if not particularly specified, shall be furnished, delivered and installed by the contractor without additional expense to PGCPS.

B. The contractor shall note that all items of equipment are specified in the singular; however, the contractor shall provide and install the number of items of equipment as indicated on the drawings and as required for a complete system.

C. It is the intention of the specifications and drawings to call for finished work, tested, and ready for operation. Wherever the word "provide" is used, it shall mean, "provide and install complete and ready for use."

D. Minor details not usually shown or specified but necessary for proper installation and operations shall be included in the contractor's estimate, the same as if herein specified or shown.

1.03 APPLICABLE SPECIFICATIONS, CODES, STANDARDS AND PERMITS

A. All equipment, materials and installation shall conform to the requirements of national, state and local codes, laws, ordinances, rules and regulations. All utility connections shall conform to the requirements of the local utilities.

B. Unless otherwise specified herein or shown on the contract drawings, the work and materials shall conform to the applicable requirements of the following codes, standards and regulations:

1. BOCA Building Officials & Code Administrators International, Inc.
2. ICC International Code Council
3. AMCA Air Movement and Control Association International, Inc
4. AHRI Air Conditioning & Refrigeration Institute
5. ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers
6. ASME American Society of Mechanical Engineers
7. ASTM American Society of Testing Materials
8. NEC National Electrical Code
9. NFPA National Fire Protection Association
10. OSHA Occupational Safety and Health Association

11. SMACNA Sheet Metal and Air Conditioning Contractors National Association
12. UL Underwriters Laboratories, Inc.
13. ANSI American National Standards Institute
14. AWS American Welding Society
15. NEMA National Electrical Manufacturer's Association
16. CISPI Cast Iron Soil Pipe Institute
17. IRI Industrial Risk Insurers
18. CAA Clean Air Act Amendment of 1990 (Title VI, Section 608)
19. CTI Cooling Tower Institute

C. Contractor shall give all necessary notices, obtain all permits and pay all Government taxes, fees and other costs, including costs for water, sewer, and gas connections or extensions including meters, in connection with his work, file all necessary plans, prepare all documents and obtain required certificates of inspection for work and deliver same to Owner before request for acceptance and final payment for work.

D. The contractor shall be responsible for purchasing equipment and appliances that bear the label of an agency, as approved by the Department of Public Works and Transportation (DPW&T), Prince George's County. It shall be the responsibility of the contractor to pay for any label testing of equipment or appliances that are installed without the label of a DPW&T approved agency.

1.04 SHOP DRAWINGS

A. The contractor shall submit eight (8) copies of the shop drawings to the Architect for review with ample time for checking prior to delivery of any of this equipment or material to the job site. The project's and the contractor's names shall be on each submittal.

B. Shop drawings shall be submitted on all major pieces of equipment and material. Each item of equipment proposed shall be a standard catalog product of an established manufacturer. The shop drawing shall give complete information on the proposed equipment such as: capacity, size, construction, material, dimensions, arrangement, operating clearances, performance characteristics, weight and rating authority. Each item of the shop drawing shall be properly labeled, indicating the intended service of the material.

C. The contractor shall, before submitting the shop drawings of the equipment to the Architect, check each item of the shop drawings to verify the proper equipment. Items to check shall include but not be limited to:

1. Will equipment physically fit into space;
2. Proper equipment for the job; electrical characteristics;
3. Voltage matches that of electric service; proper arrangements for connections;
4. Meets code requirements.

D. The shop drawings shall be neatly bound and submitted to the Architect with a letter of transmittal, which shall list each item, submitted with the manufacturer's name.

E. Review of the shop drawings shall not be considered as a guarantee of measurements or building conditions. Where drawings have been reviewed, said review does not mean that drawings have been checked in detail; said review does not in any way relieve the contractor from his responsibility or the necessity of furnishing material or performing work as required by the contract drawings.

1.05 EQUIPMENT DEVIATIONS

A. Where the contractor proposes to use an item of equipment other than the prototype equipment (a specified manufacturer's equipment used as the basis of design) or that detailed on the drawings which requires any redesign of the structure, partitions, foundations, piping, wiring or any other part of the mechanical, electrical or architectural layout, all such redesign and all new drawings and detailing required therefore shall be prepared by the contractor at his own expense and be approved by PGCPS Building Services.

B. Where such deviation from the prototype equipment requires a different quantity and arrangement of materials and equipment, the contractor shall furnish and install any such ductwork, piping, structural supports, insulation, controllers, motors, starters, electrical wiring and conduit and any other additional equipment required by the system at no additional cost to PGCPS.

1.06 QUALIFICATIONS FOR BIDDERS

A. The contractor shall examine drawings and specifications relating to work of all trades and become fully informed as to the extent and character of work required and its relation to all other work in the project prior to submission of bid or prior to start of any construction covered by these specifications and drawings.

B. Before submitting bid the contractor shall visit the site and examine all adjoining existing building, equipment and space conditions on which his work is in any way dependent, for the best workmanship and operation according to the intent of the specifications and drawings. Contractor shall verify dimensions and fully inform himself as to the nature and scope of the proposed work and also the conditions under which it is to be conducted. He shall report to PGCPS any conditions that in his estimation might preclude him from installing his equipment and work in the manner intended and noted on the drawings and in this specification. Failure to take the above precaution will in no way relieve the contractor from his obligations to provide the material and work as indicated and as specified without additional cost to PGCPS or extension of completion time.

1.07 SUBMITTALS

A. This contractor shall be responsible for participation and Submittals

B. Submit per the requirements of Division 1.

C. Product Data: Material Safety Data Sheets (MSDS).

D. Certifications: Lead-Free Plumbing Certification.

E. Sustainability Submittals: Provide the following in accordance with Sustainability Requirements: Division 1.

1. Materials Sustainability Documentation Form.

2. Product data for adhesives and sealants, paints and coatings indicating VOC content.

F. If applicable, contractor shall submit to PGCPS any required applications for utility rebates and/or incentives for each eligible piece of equipment in project. Contractor is responsible for furnishing all engineering submittals, drawings, calculations, HVAC load modeling as required for rebate and incentive programs. Contractor shall work in conjunction with PGCPS Management Analyst under the Department of Building Services during the design phase of the project to complete and submit necessary forms. This shall be coordinated prior to purchase of any eligible equipment provided under Division 23.

1.08 DRAWINGS

A. The drawings are diagrammatic, indicating general arrangement of work, and should not be scaled to establish location of work. The drawings show the size of piping and ductwork branches, risers and equipment, and must be followed. Where a change of location or method of running becomes necessary due to obstructions or other construction difficulties, such changes shall be made after securing approval

of PGCPS in writing and at no increase in amount of contract.

B. Hand drawn or scanned architectural backgrounds on construction documents will not be accepted.

C. Provide required accessories, appurtenances, hardware, fittings and devices whether separate or integral, and whether or not expressly indicated, to achieve intended component, device and system operation.

D. If pipe or duct size indicated does not match connection size of equipment to which it is connected, provide required transition piece to match equipment size.

E. Contract Documents related to Fire Protection Systems are schematic and do not include all details required for design and construction of fire protection systems in compliance with requirements of NFPA standards, insurance underwriter guidelines and governing building and fire codes.

F. Do not furnish, install or disturb materials or products containing asbestos.

G. Do not furnish, install or disturb materials or products containing asbestos.

H. Decisions regarding any and all substitutions and options permitted by the specifications shall be submitted for approval to PGCPS. Approval will only be recognized when in writing.

I. In finished spaces all piping and ductwork shall be concealed or run behind furring unless shown otherwise. Where concealing is not possible, piping and ductwork may be exposed after obtaining written approval from PGCPS.

J. All horizontal piping and ductwork not run below slab on grade shall be run as close as possible to underside of floor and parallel to building lines. Maintain maximum headroom in all areas.

K. All vertical piping and ductwork shall be run as close to walls and partitions as possible.

L. Coordination of all other trades prior to erecting any piping or ductwork is required to avoid conflict between various components of the building.

1.09 FOUNDATIONS AND SUPPORTS

A. Contractor shall provide all necessary foundations, supports, pads and bases required for mechanical equipment and any other equipment furnished under this contract, unless covered under the architectural or structural work.

B. For buried concrete or cast iron sewer piping installed in filled cuts over four (4) feet in depth the contractor shall provide brick or approved equal supports or piers under piping and fittings with piers or supports extending to a depth to provide sufficient firm and adequate support to overcome the possibility of any deflection in the piping system.

C. For pumps, compressors and other rotating machinery and all equipment where foundations are indicated, furnish and install concrete pads 4" in height (unless otherwise noted) extending not less than 4" beyond equipment base in all directions. Equipment installed in areas other than slab on grade shall be installed with the appropriate vibration assembly.

D. Construction of foundations, supports, pads, bases and piers where mounted on the floor, shall be of the same materials and same quality of finish as the adjacent and surrounding flooring material.

1.10 SCAFFOLDING, RIGGING AND HOISTING

A. Unless otherwise specified, contractor shall furnish all scaffolding, rigging, hoisting, shoring and services necessary for erection and delivery into the premises for any equipment and apparatus furnished and shall remove same from premises when no longer required.

1.11 EXCAVATION AND BACKFILL

A. The contractor shall be responsible for excavation, backfill, tamping, shoring, bracing, pumping, street cuts, repairing of finished surface and all protection for safety of persons and property as required for installing a complete mechanical/plumbing system. All excavation and backfill shall conform to the architectural section of the specifications.

B. It shall be the responsibility of the contractor to check the indicated elevations of utilities entering and leaving the building. If such elevations require excavations lower than the footing levels, PGCPS shall be notified of such conditions in writing and redesign shall be made before excavations are commenced. It is also the responsibility of the contractor to make the excavations at the minimum required depths in order not to undercut the footings.

C. Trenching shall be excavated below the installation level of the bottom of the pipe. The trench shall be filled with sand or fine gravel so entire length of barrel of piping rests on solid bed of sand or fine gravel. The backfill shall be filled in layers of 6” max depth and such layers shall be compacted after each placement.

D. Excavation shall be made in a manner to provide a uniform bearing for pipes. The pipe elevation shall be determined by the contractor to meet the plumbing codes. Where rock is encountered, excavate 3" below pipe grade and back fill with sand to the installation level of the pipe. The pipe, including the joints, shall not rest on rock at any point.

E. After required test and inspections, backfill the ditch and tamp. The first foot above the pipe shall be hand backfilled with rock free clean earth. The backfill in the ditches on the exterior and interior of the building shall be tamped to 95% of the standard Proctor maximum dry density (ASTM D-698). The contractor shall be responsible for any of his ditch walls that cave in.

1.12 ELECTRICAL WORK

A. Provide work required for electrical service, field wiring and connections for mechanical equipment in accordance with Electrical: Division 16.

B. Power wiring to terminals of motors specified under Divisions 13 and 15, including disconnects at motors, when required, are provided under Electrical: Division 16. Interlock and control wiring are provided under Instrumentation and Control Equipment: Division 13, except as otherwise indicated.

C. Electrical components of mechanical equipment, including control panels, shall be UL listed and bear label of Underwriters Laboratories, Inc. (UL). Motors, starters and control panels shall be in accordance with Motors, Starters and Control Panels: Section 15190.

D. Furnish equipment manufacturer electrical wiring diagrams and information.

E. Refer to Electrical: Division 16 for Electrical Requirements of Packaged Mechanical Equipment.

1.13 PAINTING AND COATING

A. Comply with Finishes: Division 9.

B. Touch up welds of galvanized surfaces with galvanizing primer in accordance with Metals: Division 5.

C. Prime and paint bare supplemental steel, supports and hangers required for installation of Division 15 Work, in accordance with Finishes: Division 9.

1.14 ACCESSIBILITY

A. The contractor shall locate equipment, which must be serviced, operated or maintained in fully accessible position. Equipment shall include but not be limited to: valves, traps, or low limit devices, damper operators, motors, controllers, drain points, fusible links of fire dampers, fire dampers, filters, etc. If required for better accessibility, furnish access doors for this purpose. Minor deviations from drawings may be made to allow for better accessibility, and any change shall be approved. Motor starters shall be installed not more than 6'-0" above finished floor unless otherwise approved by PGCPS.

B. All filters furnished with air handling equipment shall be readily removable from sides or bottom of cabinet as required by equipment location. Contractor shall verify location of all equipment and proper location of access to filters for removal before submitting shop drawings, placing order for equipment and setting and connecting of equipment. Any filters deemed by PGCPS to be inaccessible after installation will be made accessible by the contractor at no additional cost to PGCPS.

1.15 RECORD DRAWINGS

A. The contractor shall keep daily updated accurate records of all deviations in work as actually installed from work indicated on the contract drawings. The record drawings shall be kept at the job site, available to PGCPS at all times and labeled as "Project Record Information - Job Set". When work is completed, one complete set of marked-up prints shall be delivered to PGCPS.

1.16 MATERIAL SAFETY DATA SHEETS

A. Submit Material Safety Data Sheets (MSDS) of chemicals, hydraulic fluids, seal oils, lubricating oils, glycols and other hazardous materials used in construction, storage, startup and commissioning of equipment, in accordance with U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) hazard communication and right-to-know requirements stipulated in 29 CFR 1910.1200 (g).

1.17 METRIC SYSTEM

A. Pressure and vacuum values presented in kPa, Pa or other metric system units represent absolute pressure values unless indicated otherwise. Barometric pressure, unless otherwise indicated, is to be taken as 101.325 kPa.

1.18 FIRESTOPPING

A. Firestopping: Division 7.

1.19 PATENT RIGHTS

A. Provide trade-named material where indicated. Do not build facsimile of patented equipment which might infringe upon patent rights.

1.20 PERSONNEL INSTRUCTION AND OPERATING INSTRUCTIONS

A. The contractor shall submit for approval three (3) copies of all of the manufacturer's installation, operating and maintenance manuals for all new mechanical equipment listed in the equipment schedule, all necessary components of mechanical equipment, testing and balancing reports, equipment start-up records, equipment capacity (input and output) and a list of filter sizes and belt sizes for all mechanical equipment that requires filters and belts (this includes, but is not limited to, fan coils, unit ventilators, rooftop units, cabinet heaters, exhaust fans and air handlers). Submit four (4) copies of the operating and maintenance manuals for the automatic temperature control system components and diagrams for approval. A complete written narrative of how each system is intended to operate shall be included. Manuals shall be assembled in black vinyl hardback loose-leaf binders, labeled with job name, address and date. Information on each piece of equipment of system shall be in a separate tab labeled section. Provide a complete index of the contents. After approval by the Engineer the binders shall be forwarded to PGCPS.

B. After all tests are conducted and approved as specified below, furnish a competent operating engineer for a period of three working days to instruct and demonstrate to PGCPS or his authorized representative the operation of the system. The mechanical systems demonstration shall not coincide with the electrical demonstration. Notify PGCPS in writing of the person to whom this instruction was given and the date it was given.

C. On phased construction projects the aforementioned equipment start-up records shall be completed and made available to PGCPS for review prior to the occupancy of the completed phase.

D. Tests:

1. The contractor shall, at his expense, conduct capacity and general operating tests on each system. The test shall demonstrate the specified capacities of the various pieces of equipment and shall be conducted in the presence of PGCPS or his authorized representative. The general operating tests shall demonstrate that the entire equipment is functioning in accordance with the contract documents. Furnish all instructions and test equipment.
2. After all systems are completely tested, submit three copies of the test results to PGCPS for approval before final acceptance of project.

1.21 SYSTEM SELECTION

A. Preferred System Choices:

1. Buildings 60,000 GSF and Larger:
    a. 4-pipe central station Air Handling Units (AHU) with Variable Frequency Drives (VFD) and Variable Air Volume (VAV) air distribution system using standard or low temperature supply air, variable flow piping, and central heating/cooling plant.
    b. 4-pipe Fan Coil Unit (FCU)/Energy Recovery Unit (ERU) system with central heating/cooling plant
    c. Packaged heating/cooling systems
    d. Geothermal heat pump systems
    e. Other alternatives as approved by PGCPS

B. Buildings 59,999 GSF and Smaller:

1. 4-pipe central station Air Handling Units (AHU) with Variable Frequency Drives (VFD) and Variable Air Volume (VAV) air distribution system using standard or low temperature supply air, variable flow piping, and central heating/cooling plant.
2. 2-pipe or 4-pipe Fan Coil Unit (FCU)/Energy Recovery Unit (ERU) system with central heating/cooling plant
3. Packaged heating/cooling
4. Geothermal/condenser water heat pump systems
5. Other alternatives as approved by PGCPS

C. Unapproved System Choices:

1. Variable Refrigerant Flow
2. 2-pipe systems in buildings above 59,999 GSF with exception of geothermal type systems
3. Chilled beam systems

1.22 DESIGN CONDITIONS

A. Zoning

1. Unless deemed unfeasible, each classroom shall be a separate thermostatic zone.
2. Areas that require powered exhaust by code shall not be grouped with other areas.

B. Interior Space Temperature and Humidity

1. Occupied spaces shall be designed to meet the following requirements:
    a. Summer: 72° DB, 50% RH (Occupied setpoint: 76° DB; no higher than 78° DB)

b. Winter: 72°F DB, 40% RH (Occupied setpoint: 70° DB; no lower than 68° DB)

2. Data centers shall be designed to meet the following requirements year round:

a. 72° DB, 45% RH

b. Stand alone cooling shall be designed and installed for n+1 redundancy in case of unit failure. Units shall be able to maintain operation independent of main building system.

C. Winter outside air design temperature shall be 11° DB, with low ambient conditions being designed to 0° DB.

D. Ventilation shall be designed to meet requirements as outlined in the International Mechanical Code or ASHRAE standards, whichever is more stringent. Natural ventilation shall not be acceptable.

E. Hydronic Systems Operating Temperatures

1. Unless otherwise noted, chilled water supply and return temperatures in all systems shall be designed to 45°F entering and 55°F leaving.

2. Unless otherwise noted, boiler heating water supply temperatures shall not exceed 160°F.

3. Unless otherwise noted, geothermal heating water supply temperatures shall not descend below 100°F.

F. Target noise criteria levels in design spaces exclusive of noise generated by the occupants or equipment within the space are as follows:

1. Classrooms: NC 35

2. Conference Rooms: NC 30

3. Gymnasium: NC 45

4. Multi-Purpose Room: NC 35

5. Nurse/Health Rooms: NC 30

6. Open Offices: NC 35

7. Private offices: NC 30

8. Server Rooms/Printing Areas: NC 50

1.23 COORDINATION OF WORK

A. The contractor shall give full cooperation to other trades and shall furnish in writing, with copies to PGCPS, any information necessary to permit the work of all trades to be installed satisfactorily with the least possible interference or delay.

B. Coordinate demolition and installation of mechanical work with work of other trades, building conditions and sitework.

C. Do not deviate from Work indicated without written approval by PGCPS.

D. Where interferences occur and mechanical work must be relocated to allow for completed Work in accordance with Contract Documents, provide relocation at no additional cost. Contractor shall prepare composite working drawings of affected areas at a scale not less than 1/4" = 1'-0" clearly showing how his work is to be installed in relation to the work of the other trades. If the contractor installs work before coordinating with other trades or as to cause any interference with work of other trades, necessary changes shall be made to correct the condition without additional cost to PGCPS.

E. Coordinate with work of Division 9 to determine location of required access panels for mechanical work. Locate access panels as required to service mechanical equipment.

F. Coordinate with Work of Division 13 to determine quantity, size and location of pipe-mounted, duct-mounted and mechanical-equipment-mounted instrumentation devices installed under Division 15.

G. Coordinate location of floor drains, plumbing fixtures, equipment and specialties with work indicated on Architectural Drawings.

H. Structural support elements as shown on the drawings must be in place prior to the installation of piping or the setting of rooftop equipment. The contractor shall not install any piping or rooftop equipment until such elements are in place.

1.24 CONNECTIONS AND SHUTDOWNS TO EXISTING WORK

A. Coordinate with PGCPS to schedule Work requiring interruption of services during unoccupied periods to avoid interruption of services during normal working hours, in accordance with Division 1. Do not interrupt or connect to working systems without prior written approval by PGCPS.

B. Scheduling of Work: Work shall be performed in the sequence, locations and time periods agreed to by the Owner prior to commencement of work.

C. The contractor shall submit written requests to disconnect any existing utility services and to obtain equipment downtime. Only after receiving PGCPS approval of these requests shall work be allowed to proceed. This contractor shall be responsible for restoring the existing utilities. If contractor fails to provide domestic hot/cold water, gas, sewers, air conditioning and/or heating systems as specified herein it is understood and agreed that there will be liquidated damages deducted in the amount as stated in Division 01010, per school per consecutive calendar day.

D. Dust Control: The amount of dust resulting from connecting existing utilities shall be controlled to avoid creation of a nuisance in the surrounding area. Masks shall be worn for protection against dust inhalation by all persons in the vicinity of work involving removal of masonry.

E. Protection of Existing Work:

1. Existing work and furnishings to remain shall be protected from damage. Work damaged by the Contractor shall be repaired to match existing work without any additional cost to the PGCPS.
2. Cover equipment as necessary, to protect it from dust.
3. Floors shall be protected from damage.
4. At the end of each workday and during inclement weather, close exterior openings with weatherproof cover.
5. Provide temporary filter media on any portions of existing ductwork which communicate with corridors and construction areas. This media shall be checked frequently and changed as necessary.

F. Environmental Protection: Contractor shall comply with all Federal and local regulations pertaining to Environmental Protection.

G. Removal of Existing Equipment and Materials: Existing equipment and materials shall be dismantled and/or cut-up so as to be removable through existing building's access passages. No alterations to the building shall be made for the purpose of removing existing equipment and material.

H. Clean-up:

1. Debris and Rubbish: Remove debris and rubbish from the site daily. Do not allow to accumulate in building or on site.
2. Debris Control: Remove and transport debris in a manner so as to prevent spillage on site or adjacent areas.
3. Regulations: Local regulations regarding hauling and disposal shall apply.

1.25 IDENTIFICATION

A. Refer to Identification of Mechanical Equipment and Piping Systems: Section 15075.

1.26 EQUIPMENT BY OWNER

A. Refer to other Sections for equipment furnished by PGCPS.

B. Coordinate to assure clearance for moving PGCPS-furnished equipment to its final location.

C. Comply with Division 1 for setting in place and protection of Owner-furnished equipment.

D. Obtain pertinent data for equipment-required mechanical services.

E. Provide roughing-in for PGCPS-furnished equipment.

F. Provide coordination of foundations and structural support for PGCPS-furnished equipment, and identify revisions required to Contract Documents.

G. Provide mechanical services, including piping and ductwork, and make final connections to PGCPS-furnished equipment.

H. Provide painting and identification for PGCPS-furnished equipment.

I. Provide accessories, fastenings and fittings as required for installation and proper equipment operation.

J. Furnish testing and balancing services for PGCPS-furnished equipment.

1.27 PASSAGE OF EQUIPMENT

A. Comply with Division 1.

B. Verify that equipment, including equipment furnished by PGCPS, will pass through final available openings. When equipment or sections of equipment are larger than available openings, install this equipment prior to construction of walls, floors or roofs. Use planking or cribbing as required to protect adjoining construction from damage. Protect equipment from damage until construction is completed.

C. When equipment or sections of equipment are larger than available openings through existing structures, contractor shall construct a means of passage and repair any structure as required at no additional cost to PGCPS.

1.28 PROVISIONS FOR CHASES, OPENINGS AND INSERTS

A. Comply with Division 1.

1.29 CUTTING AND PATCHING

A. Comply with Division 1.

B. Coordinate and show locations and sizes on Coordination Drawings for penetrations of mechanical Work, including ductwork and piping through walls, floors, partitions, roofs, and for core-drilled openings.

1.30 MANUFACTURER'S SERVICES

A. Division 15 Sections indicate which manufacturer services including supervision, startup, factory and field testing, and Owner personnel training are required for various systems and equipment.

B. Division 15 Sections indicate details, scheduled dates and durations of each service, as required.

1.31 SERVICE AND MAINTENANCE

A. Division 15 Sections indicate which equipment and systems require contracted service and maintenance after Date of Owner Acceptance.

B. Division 15 Sections indicate requirements for service/maintenance organizations to offer renewal of Service and Maintenance Contracts to Owner at conclusion of Contract Work.

1.32 COMPLIANCE WITH CODES, REGULATIONS AND STANDARDS

A. Comply with Division 1.

1.33 PRODUCT SUBSTITUTIONS

A. Unless substitutions are prohibited, submit substitutions of material and equipment in accordance with requirements of Division 1.

B. If requested by Owner's Representative, submit independent test results for substituted products that establish compliance with indicated criteria. If independent test results are not available, furnish independent testing at no additional cost.

PART 2 PRODUCTS

2.01 GENERAL

A. Use adhesives and sealants that comply with the VOC limits specified in Sustainability Requirements: Division 1.

B. Any paints and coatings applied in the field must comply with the VOC limits specified in Sustainability Requirements, Division 1.

PART 3 EXECUTION

3.01 INSTALLATION, STARTUP AND TESTING

A. This contractor is responsible for the checkout and start-up of all equipment and systems. Equipment start-up shall be in accordance with the manufacturer's requirements and recommendations and shall be performed by personnel who are knowledgeable with the equipment and its requirements. When required by the equipment manufacturer or as noted in the specifications, equipment checkout and start-up shall be performed by personnel certified by the manufacturer. Evidence of proper certification of startup personnel shall be provided to PGCPS.

B. All close out and start-up activities are the responsibility of this contractor.

C. This contractor shall notify PGCPS two weeks prior to equipment checkout and start-up.

D. Systems and equipment shall be operated at both full and part load conditions to ensure specified requirements can be achieved.

E. Where manufacturer's services are indicated, manufacturer's representative shall inspect installation prior to, and be present during system startup and testing.

F. Do not operate systems unless all system components have been properly installed and tested and system monitoring and controls have been properly commissioned and are deemed duly connected, functional and safe.

G. The equipment manufacturer's checkout and start-up logs shall be completed in their entirety; should a reference be non-applicable it shall be marked as such. Copies of completed logs shall be submitted to PGCPS personnel the day of checkout and start-up activities, as well as included in the Operation and Maintenance manual.

END OF SECTION

Part 1 - General

I. Summary (Non-inclusive)

A. Section Includes: Demolition, removal, relocation, rerouting and reconnection of existing mechanical facilities, as required, indicated and specified herein, to accomplish alteration, restoration and to accommodate new construction and as follows:

1. Work includes draining, disconnecting, relocating, removing and dismantling, in a neat and good workmanlike manner, the items and their accessories as indicated on Drawings.
2. Do not enter Project Site or begin Work of this Section until asbestos abatement and removal Work, as specified in Article, Insulation Removal, has been completed an Asbestos Abatement Contractor approved by PGCPS.
3. PGCPS will certify in writing to Contractor that certain areas at the Project Site, where asbestos materials are present, are non-hazardous and able to be entered by Contractor's workers.

II. Related Work Specified Elsewhere (Non-Inclusive)

A. Applicable Sections: Division 1.

B. Building Demolition: Division 2.

C. Electrical Demolition, Relocation and Alteration: Division 26.

III. Submittals

A. Submit per the requirements of Division 1.

B. Quality Control Procedures:

1. Demolition Schedule and Procedures: Division 1.
2. Fire Watch Procedures: As specified in Article, Special Precautions.
3. Inspection Report of Underground Piping Systems: As specified in Article, General.
4. Welding/Burning Permit: Obtain a welding/burning permit from local Fire Official prior to start of any welding or burning in accordance with local Fire Code.

C. Certifications:

1. Refrigerant Technician EPA Certification: In accordance with Article, Refrigerant Removal.

IV. Quality Assurance

A. Referenced Codes and Standards: Comply with the following in accordance with Division 1.

1. International Building Code
2. NFPA Fire Code
3. International Plumbing and Fuel Gas Code
4. National Electric Code

5. WSSC Utility Company requirements for gas piping
6. Owner's Fire Insurance Carrier's Requirements
7. American National Standards Institute (ANSI)
   a) A10.6 - Safety Requirements for Demolition Operations
8. National Demolition Association (NDA)
   (a) Demolition Safety Manual
9. National Fire Protection Association (NFPA)
   a) 51B - Standard for Fire Protection During Welding, Cutting and Other Hot Work
   b) 70 - National Electrical Code
   c) 241 - Safeguarding Construction, Alteration and Demolition Operations
10. U.S. Department of Labor, Occupational Safety and Health Administration (OSHA)
    a) 29 CFR 1910 - Occupational Safety and Health Standards
11. U.S. Environmental Protection Agency (EPA)
    (a) Clean Air Act Amendments of 1990

V. Special Precautions

A. Torch cutting of ductwork is not acceptable.

B. Torch cutting mechanical equipment is permitted only with specific written approval of PGCPS.

C. Draining operations must not damage building components.

Part 2 - Products

I. General

A. Materials used for this Work shall be in accordance with applicable Sections in Mechanical: Division 15.

Part 3 - Execution

I. General

A. Provide alteration and demolition of mechanical facilities as required by Drawings and Specifications. Drawings are diagrammatic and do not indicate exact location of all existing mechanical work.

B. Do not begin Work until time schedules and manner of operations have been approved by PGCPS. Include interruptions of existing services in schedules as approved by PGCPS. Prior to starting Work, visit Project Site and become familiar with area. Obtain written permission from PGCPS prior to commencing Work.

C. Inspect and verify location of existing mechanical equipment, piping, fittings, valves, ductwork, insulation, controls, and other mechanical facilities. Provide for removal, relocation, rerouting

and reconnection of this Work and related Work required by demolition methods or sequences. Comply with installation procedures, materials, and support equipment specified in applicable Division 15 Sections.

D. Where existing equipment is to remain in service during construction, provide rerouting and reconnection of mechanical services as required to maintain continuous service.

E. Where existing systems shall remain in service during construction, maintain system continuity and operation of piping and ductwork circuits, whether modified, spliced, extended, relocated or newly constructed.

F. Review removed equipment with PGCPS prior to disposal. Completely remove existing ductwork, piping, conduit and similar items to be abandoned that are not embedded in walls or floor slabs unless otherwise indicated. Cap open ends at walls and flush with floors. Dispose of existing materials and equipment, not intended for reuse in Work, in a location directed by PGCPS. Where pipes or ducts penetrating a roof are documented to remain, cap pipe or duct on outside of penetration.

G. Store and protect, at locations designated by PGCPS on Project Site, existing material and equipment indicated to be retained for future use by Owner.

H. Temporarily cap ends of ductwork, sanitary piping and sanitary vent piping to remain.

I. If unsure as to disposition of any portion of demolition, request clarification from PGCPS prior to removal. If material and equipment not intended for removal are removed, replace that material and equipment in manner acceptable to Owner' Representative at no additional cost.

J. Where existing louvers or ductwork penetrations are to remain, blank-off louver on inside with galvanized sheet metal on both sides of 2 inch thick, 6 pcf density rigid fiberglass board insulation. Paint side attached to louver with flat black paint.

K. Prior to commencing with Work, inspect underground piping to which new construction will be connected, or existing systems currently feed from or discharge to, and prepare written report for each underground piping system defining existing conditions as listed below. Submit report to PGCPS Project Manager for review and comment. Do not proceed with Work until receiving a written "NOTICE TO PROCEED" from PGCPS Project Manager after submitting report.

L. Pipe system service.

1. Pipe size and invert elevation.
2. Materials of construction.
3. Nature and type of containment.
4. Nature and type of corrosion protection.
5. Status (active or inactive).

6. Condition (suitability for continued used in respective service).
7. Intended method of performing the Work, including shutdown schedule.
8. Deviations from Contract Documents.

II. Piping Removal

A. Cut off welded piping square at locations indicated. Do not cut where demolition ends at flanged valve or equipment. Close off openings of remaining valves, piping or fittings with weld caps or blind flanges to prevent debris from entering existing systems.

B. Disconnect threaded piping at locations indicated. Close off openings of remaining valves, piping, fittings and equipment with pipe plugs or pipe caps as indicated.

C. Remove pipe hangers, supports, miscellaneous steel and anchors with piping.

III. Protection From Freezing

A. It is intended that building remain protected from damage due to freezing temperatures. To that end, existing equipment and systems used for heating shall remain in place and in operation until scheduling and weather permit shutdown.

B. Where, for example, removal of equipment will leave an area unprotected from freezing, notify PGCPS 72 hours prior to removal. Provide temporary heating equipment sufficient to prevent freezing.

IV. Disconnection And Interruption Of Mechanical Services

A. When portions of existing piping system including, but not limited to, domestic water piping, sprinkler piping, natural gas piping, drainage piping, steam piping, chilled water piping, hot water heating piping, condensate piping, refrigerant piping and control air piping or ductwork system are removed, and this removal causes loss of operation to another piece of equipment due to open disconnected piping or ductwork, then cap piping or ductwork or provide temporary piping or ductwork system to retain operation of the affected systems.

B. Fire protection systems and appliances, including fire alarm and detection systems, shall be maintained and capable of proper operation at all times. Notify local Fire Official before disconnection and interruption of any fire protection system, and before tests, repairs, alterations or additions are started, and upon its completion.

V. Mechanical Equipment Removal

A. Remove mechanical equipment indicated to be removed on plans, including (but not limited to) equipment's supply and return piping, refrigerant piping, condensate piping, domestic water piping, drainage piping, valves, insulation, ductwork, hangers, supports, controls, associated components, and all line- and low-voltage wiring, unless otherwise indicated. Remove all

electrical Work, including wiring between equipment, and wiring to power source or point of origin.

B. Remove equipment steel or structure supports.

VI. Refrigerant Removal

A. Recover and dispose of all existing refrigerant charges in accordance with EPA regulations. Release of chlorofluorocarbon refrigerants to atmosphere is prohibited in accordance with Clean Air Act Amendments of 1990.

B. Technicians involved in refrigerant related Work shall possess appropriate EPA certification.

VII. Ductwork Removal

A. Disconnect ductwork to be removed at closest joint and resupport remaining ductwork.

B. Prepare remaining ductwork joints at point of disconnection to receive new ducts or blank-off panels.

C. Remove ductwork supports and miscellaneous steel with ductwork to be demolished.

VIII. Insulation Removal

A. Remove non-asbestos insulation, together with piping, fittings, valves and equipment designated for demolition.

B. Existing exposed asbestos insulation and gasketing materials should not be encountered in this Work. If there is doubt as to whether asbestos materials may be present on existing piping or dismantled equipment, stop removal Work affecting suspected asbestos immediately and advise PGCPS of this action.

C. If existing exposed asbestos insulation and gasketing materials will be encountered in this Work as stated in certain areas as marked and color-coded by PGCPS, do not perform removal Work affecting asbestos.

D. Detection, abatement, replacement, removal and disposal of asbestos materials can only be performed under supervision and control of a qualified specialist retained by PGCPS.

IX. Control Wiring Removal

A. Disconnect and remove control wiring and tubing, including conduit, associated with equipment to be removed. Where it is not possible to remove conduit, remove wiring and tubing and cap or seal conduit in place.

X. Providing Temporary Domestic/Fire Protection Water

A. Building's domestic/fire protection water supply must remain operational during all phases of demolition. During periods when water supply is not operational, provide fire watches in accordance with PGCPS's fire insurance carrier's requirements and Prince George’s County

Fire Marshal. Ensure that staging of water service for building is carefully planned so that there will be an uninterruptible supply of water to building at all times.

END OF SECTION

Part 1 - General

I. Summary
   A. This section includes the following:
      1. Piping materials and installation instructions common to most piping systems.
      2. Mechanical sleeve seals.
      3. Sleeves.
      4. Grout.
      5. Mechanical demolition.
      6. Equipment installation requirements common to equipment sections.
      7. Concrete bases.
      8. Supports and anchorages.

II. Definitions
   A. Finished spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
   B. Exposed, interior installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
   C. Exposed, exterior installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
   D. Concealed, interior installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
   E. Concealed, exterior installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

III. Submittals
   A. Welding certificates.

IV. Quality assurance
   A. Steel support welding: qualify processes and operators according to AWS D1.1, "Structural welding code--steel."
   B. Steel pipe welding: qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "welding and brazing qualifications."
      1. Comply with provisions in asme B31 series, "code for pressure piping."
      2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

Part 2 - Products

I. Pipe, Tube, and Fittings
   A. Refer to individual Division 15 piping sections for pipe, tube, and fitting materials and joining methods.
   B. Pipe threads: ASME B1.20.1 For factory-threaded pipe and pipe fittings.

II. Joining Materials
   A. Refer to individual division 15 piping sections for special joining materials not listed below.
   B. Pipe-flange Gasket Materials: ASME B16.21, Non-metallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
   C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
   D. Brazing Filler Metals: AWS A5.8, BCuP series or BAg1, unless otherwise indicated.
   E. Welding Filler Metals: comply with AWS D10.12.

III. Dielectric Fittings
   A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
   B. Insulating Material: Suitable for system fluid, pressure, and temperature.
   C. Dielectric Nipples: Electroplated steel nipple with inert and non-corrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg f.

IV. Mechanical Sleeve Seals
   A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
   B. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   C. Pressure Plates: Carbon steel. Include two for each sealing element.

D. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

V. Sleeves

A. Galvanized-steel sheet: 0.0239-Inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel pipe: astm a 53, type e, grade b, schedule 40, galvanized, plain ends.

C. Cast iron: cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack sleeve fittings: manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck clamp: clamping ring with set screws.

VI. Grout

A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: post-hardening, volume-adjusting, non-staining, non-corrosive, non-gaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

Part 3 - Execution

I. Mechanical demolition

A. Refer to Division 1 Sections "Cutting and Patching" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.

1. Piping to be removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to be abandoned in place: Drain piping and cap or plug piping with same or compatible piping material.
3. Equipment to be removed: Disconnect and cap services and remove equipment.
4. Equipment to be removed and reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.

5. Equipment to be removed and salvaged: Disconnect and cap services and remove equipment and deliver to owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

II. Piping systems - common requirements

A. Install piping according to the following requirements and Division 15 sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

M. Aboveground, exterior-wall pipe penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
3. Mechanical sleeve seal installation: select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve.

Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

N. Underground, exterior-wall pipe penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical sleeve seal installation: select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

O. Fire-barrier penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to division 7 section "through-penetration firestop systems" for materials.

P. Verify final equipment locations for roughing-in.

Q. Refer to equipment specifications in other sections of these specifications for roughing-in requirements.

III. Piping Joint Construction

A. Join pipe and fittings according to the following requirements and Division 15 sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered joints: apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed joints: construct joints according to aws's "brazing handbook," "pipe and tube" chapter, using copper-phosphorus brazing filler metal complying with aws a5.8.

F. Threaded joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full id. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged threads: do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded joints: Construct joints according to AWS D10.12, Using qualified processes and welding operators according to Part 1 "Quality Assurance" article.

H. Flanged joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

IV. Piping connections

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2” and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-½” and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Wet piping systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

V. Equipment installation - common requirements

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

VI. Concrete bases

A. Concrete bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi , 28-day compressive-strength concrete and reinforcement.

VII. Erection of metal supports and anchorages

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field welding: comply with aws d1.1.

VIII. Grouting

A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

End of Section

Part 1 - General

I. Summary
   A. This Section includes basic requirements for motors.
   B. See individual Sections for application of motors and reference to specific motor requirements for motor-driven equipment.

II. Definitions
   A. Factory-Installed Motor: A motor installed by motorized-equipment manufacturer as a component of equipment.
   B. Field-Installed Motor: A motor installed at Project site and not factory installed as an integral component of motorized equipment.

III. Submittals
   A. Product Data for Field-Installed Motors: For each type and size of motor indicated, provide nameplate data and ratings; mounting arrangements; size, type, and location of winding terminations; conduit entry and ground lug locations; and information on coatings or finishes.
   B. Shop Drawings for Field-Installed Motors: Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Include the following:
      1. Each installed unit's type and details.
      2. Nameplate legends.
      3. Diagrams of power and control wiring. Provide schematic wiring diagram for each type of motor and for each control scheme.
   C. Qualification Data: For testing agency.
   D. Field quality-control test reports.
   E. Operation and maintenance data.

IV. Quality Assurance
   A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
   B. Comply with NFPA 70.

V. Coordination
   A. Coordinate features of motors, installed units, and accessory devices. Provide motors that are:

1. Designed and labeled for use with variable frequency controllers, and suitable for use throughout speed range without overheating.
2. Matched to torque and horsepower requirements of the load.
3. Matched to ratings and characteristics of supply circuit and required control sequence.

B. Coordinate motor support with requirements for driven load; access for maintenance and motor replacement; installation of accessories, belts, belt guards; and adjustment of sliding rails for belt tensioning.

Part 2 - Products

I. Motor Requirements

A. Motor requirements apply to factory-installed and field-installed motors, except as follows:

1. Different ratings, performance, or characteristics for a motor are specified in another Section.
2. Manufacturer for a factory-installed motor requires ratings, performance, or characteristics, other than those specified in this Section, to meet performance specified.

II. Motor Characteristics

A. Frequency Rating: 60 Hz.

B. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.

C. Service Factor: 1.15 for open drip proof motors; 1.0 for totally enclosed motors.

D. Duty: Continuous duty at ambient temperature of 105 deg F and at altitude of 3300 ft above sea level.

E. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

F. Enclosure: Open dripproof.

III. Polyphase Motors

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium efficiency.

C. Stator: Copper windings, unless otherwise indicated.

D. Rotor: Squirrel cage, unless otherwise indicated.

E. Bearings: Double-shielded, prelubricated ball bearings suitable for radial and thrust loading.

F. Temperature Rise: Match insulation rating, unless otherwise indicated.

G. Insulation: Class F, unless otherwise indicated.

H. Code Letter Designation:

1. Motors 15 hp and Larger: NEMA starting Code F or G.
2. Motors Smaller Than 15 hp: Manufacturer's standard starting characteristic.

I. Enclosure: Cast iron for motors 7.5 hp and larger; rolled steel for motors smaller than 7.5 hp.

1. Finish: Gray enamel.

IV. Polyphase Motors With Additional Requirements

A. Motors Used with Reduced-Inrush Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Designed with critical vibration frequencies outside operating range of controller output.
2. Temperature Rise: Matched to rating for Class B insulation.
3. Insulation: Class H.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Source Quality Control: Perform the following tests on each motor according to NEMA MG 1:

1. Measure winding resistance.
2. Read no-load current and speed at rated voltage and frequency.
3. Measure locked rotor current at rated frequency.
4. Perform high-potential test.

V. Single-phase Motors

A. Type: One of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split-phase start, capacitor run.
3. Capacitor start, capacitor run.

B. Shaded-Pole Motors: For motors 1/20 hp and smaller only.

C. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

D. Bearings: Ball type for belt-connected motors and other motors with high radial forces on motor shaft; sealed, pre-lubricated sleeve type for other single-phase motors.

E. Source Quality Control: Perform the following tests on each motor according to NEMA MG 1:

1. Measure winding resistance.
2. Read no-load current and speed at rated voltage and frequency.
3. Measure locked rotor current at rated frequency.
4. Perform high-potential test.

Part 3 - Execution

I. Motor Installation

A. Anchor each motor assembly to base, adjustable rails, or other support, arranged and sized according to manufacturer's written instructions. Attach by bolting. Level and align with load transfer link.

B. Install motors on concrete bases complying with Division 3.

II. Field Quality Control

A. Prepare for acceptance tests as follows:

1. Run each motor with its controller. Demonstrate correct rotation, alignment, and speed at motor design load.
2. Test interlocks and control features for proper operation.
3. Verify that current in each phase is within nameplate rating.
4. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

III. Adjusting

A. Align motors, bases, shafts, pulleys and belts. Tension belts according to manufacturer's written instructions.

END OF SECTION

Part 1 - General

I. Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

II. Summary

A. This Section includes the following general-duty valves:

1. Copper-alloy ball valves.
2. Ferrous-alloy ball valves.
3. Ferrous-alloy butterfly valves.
4. Spring-loaded, lift-disc check valves.
5. Bronze gate valves.
6. Cast-iron gate valves.
7. Chainwheel actuators.

B. Related Sections include the following:

1. Division 22 piping Sections for general-duty and specialty valves for site construction piping.
2. Division 21 fire-suppression piping and fire pump Sections for fire-protection valves.
3. Division 23 Section "Mechanical Identification" for valve tags and charts.
4. Division 23 Section "HVAC Instrumentation and Controls" for control valves and actuators.
5. Division 15 piping Sections for specialty valves applicable to those Sections only.

III. Definitions

A. The following are standard abbreviations for valves:

1. CWP: Cold working pressure.
2. EPDM: Ethylene-propylene-diene terpolymer rubber.
3. NBR: Acrylonitrile-butadiene rubber.
4. PTFE: Polytetrafluoroethylene plastic.
5. SWP: Steam working pressure.
6. TFE: Tetrafluoroethylene plastic.

IV. Submittals

A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include

rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

V. Quality Assurance

A. ASME Compliance: ASME B31.9 for building services piping valves.

1. Exceptions: Domestic hot- and cold-water piping valves unless referenced.

B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

VI. Delivery, Storage, And Handling

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

Part 2 - Products

I. Manufacturers

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

II. Valves, General

A. Refer to Part 3 "Valve Applications" Article for applications of valves.

B. Bronze Valves: NPS 2 and smaller with threaded ends, unless otherwise indicated.

C. Ferrous Valves: NPS 2-1/2 and larger with flanged ends, unless otherwise indicated.

D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream pipe, unless otherwise indicated.

F. Valve Actuators:

1. Chainwheel: For attachment to valves, of size and mounting height, as indicated in the "Valve Installation" Article in Part 3.
2. Gear Drive: For quarter-turn valves NPS 8 and larger.
3. Handwheel: For valves other than quarter-turn types.
4. Lever Handle: For quarter-turn valves NPS 6 and smaller, except plug valves.
5. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug head.

G. Extended Valve Stems: On insulated valves.

H. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.

I. Valve Grooved Ends: AWWA C606.

J. Solder Joint: With sockets according to ASME B16.18.

1. Caution: Use solder with melting point below 840 deg F for angle, check, gate, and globe valves; below 421 deg F for ball valves.

K. Threaded: With threads according to ASME B1.20.1.

L. Valve Bypass and Drain Connections: MSS SP-45.

III. Copper-alloy Ball Valves

A. Manufacturers:

1. Three-Piece, Copper-Alloy Ball Valves:
   a) Conbraco Industries, Inc.; Apollo Div.
   b) DynaQuip Controls.
   c) Grinnell Corporation.
   d) Hammond Valve.
   e) Jamesbury, Inc.
   f) Kitz Corporation of America.
   g) NIBCO INC.
   h) PBM, Inc.
   i) Red-White Valve Corp.

j) Worcester Controls.

B. Copper-Alloy Ball Valves, General: MSS SP-110.

C. Three-Piece, Copper-Alloy Ball Valves: Brass or bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig minimum CWP rating and blowout-proof stem.

IV. Ferrous-alloy Ball Valves

A. Manufacturers:

1. American Valve, Inc.
2. Conbraco Industries, Inc.; Apollo Div.
3. Cooper Cameron Corp.; Cooper Cameron Valves Div.
4. Crane Co.; Crane Valve Group; Stockham Div.
5. Flow-Tek, Inc.
6. Foster Valve Co.
7. Hammond Valve.
8. Jamesbury, Inc.
9. Jomar International, LTD.
10. Kitz Corporation of America.
11. KTM Products, Inc.
12. McCANNA, Incorporated.
13. Milwaukee Valve Company.
14. NIBCO INC.
15. PBM, Inc.
16. Richards Industries; Marwin Ball Valves.
17. Worcester Controls.

B. Ferrous-Alloy Ball Valves, General: MSS SP-72, with flanged ends.

C. Ferrous-Alloy Ball Valves: Class 150, full port.

V. Ferrous-alloy Butterfly Valves

A. Manufacturers:

1. Flanged, Ferrous-Alloy Butterfly Valves:

a) Bray International, Inc.

b) Cooper Cameron Corp.; Cooper Cameron Valves Div.

c) Grinnell Corporation.

d) Mueller Steam Specialty.

e) Tyco International, Ltd.; Tyco Valves & Controls.

B. Ferrous-Alloy Butterfly Valves, General: MSS SP-67, Type I, for tight shutoff, with disc and lining suitable for potable water, unless otherwise indicated.

C. Flanged, 150-psig CWP Rating, Ferrous-Alloy Butterfly Valves: Flanged-end type with one- or two-piece stem.

VI. Spring-loaded, Lift-disc Check Valves

A. Manufacturers:

B. Type II, Compact-Wafer, Lift-Disc Check Valves:

1. Durabla Fluid Technology, Inc.
2. Flomatic Valves.
3. GA Industries, Inc.
4. Grinnell Corporation.
5. Hammond Valve.
6. Metraflex Co.
7. Milwaukee Valve Company.
8. Mueller Steam Specialty.
9. Multiplex Manufacturing Co.
10. NIBCO INC.
11. SSI Equipment, Inc.
12. Val-Matic Valve & Mfg. Corp.
13. Valve and Primer Corp.

C. Lift-Disc Check Valves, General: FCI 74-1, with spring-loaded bronze or alloy disc and bronze or alloy seat.

D. Type II, Class 125, Compact-Wafer, Lift-Disc Check Valves: Compact-wafer style with cast-iron shell with diameter made to fit within bolt circle.

VII. Bronze Gate Valves

A. Manufacturers:

1. Type 1, Bronze, Nonrising-Stem Gate Valves:

a) American Valve, Inc.
b) Cincinnati Valve Co.
c) Crane Co.; Crane Valve Group; Crane Valves.
d) Crane Co.; Crane Valve Group; Jenkins Valves.
e) Crane Co.; Crane Valve Group; Stockham Div.
f) Grinnell Corporation.
g) Hammond Valve.

h) Kitz Corporation of America.
i) Legend Valve & Fitting, Inc.
j) Milwaukee Valve Company.
k) NIBCO INC.
l) Powell, Wm. Co.
m) Red-White Valve Corp.
n) Walworth Co.
o) Watts Industries, Inc.; Water Products Div.

B. Bronze Gate Valves, General: MSS SP-80, with ferrous-alloy handwheel.

C. Type 1, Class 125, Bronze Gate Valves: Bronze body with non-rising stem and bronze solid wedge and union-ring bonnet.

VIII. Cast-iron Gate Valves

A. Manufacturers:

1. Type I, Cast-Iron, Nonrising-Stem Gate Valves:

a) Cincinnati Valve Co.
b) Crane Co.; Crane Valve Group; Crane Valves.
c) Crane Co.; Crane Valve Group; Jenkins Valves.
d) Crane Co.; Crane Valve Group; Stockham Div.
e) Grinnell Corporation.
f) Hammond Valve.
g) Kitz Corporation of America.
h) Legend Valve & Fitting, Inc.
i) Milwaukee Valve Company.
j) NIBCO INC.
k) Powell, Wm. Co.
l) Red-White Valve Corp.
m) Walworth Co.
n) Watts Industries, Inc.; Water Products Div.

B. Cast-Iron Gate Valves, General: MSS SP-70, Type I.

C. Class 125, NRS, All-Iron, Cast-Iron Gate Valves: Cast-iron body with cast-iron trim, non-rising stem, and solid-wedge disc.

IX. Outside Stem and Yoke Valves

A. Manufacturers:

1. John Crane
2. Stockham
3. Powell, Nibco
4. Milwaukee.

B. Cast-Iron Gate Valves, General: MSS SP-70, Type I.

C. Class 125, NRS, All-Iron, Cast-Iron Gate Valves: Cast-iron body with cast-iron trim, non-rising stem, and solid-wedge disc.

X. Chainwheel Actuators

A. Manufacturers:

1. Babbitt Steam Specialty Co.
2. Roto Hammer Industries, Inc.

B. Description: Valve actuation assembly with sprocket rim, brackets, and chain.

C. Sprocket Rim with Chain Guides: Ductile iron, of type and size required for valve.Include zinc coating.

1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.

D. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

Part 3 - Execution

I. Examination

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

F. Do not attempt to repair defective valves; replace with new valves.

II. Valve Applications

A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, butterfly, or gate , gate, or plug valves.
2. Throttling Service: Angle, ball, butterfly, or globe valves.
3. Pump Discharge: Spring-loaded, lift-disc check valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

C. Chilled-Water Piping: Use the following types of valves:

1. Ball Valves, NPS 2 and Smaller: Three-piece, 400-psig CWP rating, copper alloy.
2. Butterfly Valves, NPS 2-1/2 and Larger: Flanged, 150-psig CWP rating, ferrous alloy, with EPDM liner.

D. Spring-Loaded, Lift-Disc Check Valves, NPS 2-1/2 and Larger: Type II, Class 125, cast iron.

E. Condenser Water Piping: Use the following types of valves:

1. Ball Valves, NPS 2 and Smaller: Three-piece, 400-psig CWP rating, copper alloy.
2. Butterfly Valves, NPS 2-1/2 and Larger: Flanged, 150-psig CWP rating, ferrous alloy, with EPDM liner.

F. Spring-Loaded, Lift-Disc Check Valves, NPS 2-1/2 and Larger: Type II, Class 125, cast iron.

G. Domestic Water Piping: Use the following types of valves:

1. Ball Valves, NPS 2 and Smaller: Three-piece, 400-psig CWP rating, copper alloy.
2. Gate Valves, NPS 2-1/2 and Larger: Type 1, Class 125, NRS, bronze-mounted cast iron.

H. Heating Water Piping: Use the following types of valves:

1. Ball Valves, NPS 2 and Smaller: Three-piece, 400-psig CWP rating, copper alloy.
2. Butterfly Valves, NPS 2-1/2 and Larger: Flanged, 150-psig CWP rating, ferrous alloy, with EPDM liner.
3. Spring-Loaded, Lift-Disc Check Valves, NPS 2-1/2 and Larger: Type II, Class 125, cast iron.

I. Low-Pressure Steam Piping: Use the following types of valves:

1. Gate Valves, NPS 2 and Smaller: Type 1, Class 125, bronze.
2. Gate Valves, NPS 2-1/2 and Larger: Type I, Class 125, NRS, cast iron.

J. Steam Condensate Piping: Use the following types of valves:

1. Gate Valves, NPS 2 and Smaller: Type 1, Class 125, bronze.
2. Gate Valves, NPS 2-1/2 and Larger: Type I, Class 125, NRS, cast iron.

K. Select valves, except wafer and flangeless types, with the following end connections:
   1. For Copper Tubing, NPS 2 and Smaller: Solder-joint or threaded ends, except provide valves with threaded ends for heating hot water, steam, and steam condensate services.
   2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged or threaded ends.
   3. For Steel Piping, NPS 2 and Smaller: Threaded ends.
   4. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged or threaded ends.
   5. For Steel Piping, NPS 5 and Larger: Flanged ends.

III. Valve Installation

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

C. Locate valves for easy access and provide separate support where necessary.

D. Install valves in horizontal piping with stem at or above center of pipe.

E. Install valves in position to allow full stem movement.

F. Install chainwheel operators on valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor elevation.

G. Install check valves for proper direction of flow and as follows:

H. Swing Check Valves: In horizontal position with hinge pin level.
   1. Dual-Plate Check Valves: In horizontal or vertical position, between flanges.
   2. Lift Check Valves: With stem upright and plumb.

IV. Joint Construction

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

V. Adjusting

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION

Part 1 - General

I. Summary (Non-inclusive)

A. Section Includes: Identification of mechanical equipment and piping systems.

II. Related Work Specified Elsewhere (Non-inclusive)

A. Applicable Sections: Division 1.

B. High-Performance Coatings: Division 9.

C. Painting: Division 9.

D. Pipe, Valves and Fittings for Mechanical Systems: Section 230500.

E. Pipe Insulation: Section 230700.

F. Mechanical Equipment Insulation: Section 230700.

III. Submittals

A. Submit per the requirements of Division 1.

B. Shop Drawings: Include compact disk and hard copy, as indicated, showing:

1. Identification Scheme, Identification Codes.

2. Valve Schedules: Listing proposed valve numbers, their location and function.

3. Equipment Schedules: Listing proposed equipment numbers, their location and function.

4. Steam Trap Schedules: Steam Trap Schedules listing proposed steam trap number, location, type, size and service.

C. Samples: Tags, attachments, stencils and markers, labeled and identified.

IV. Quality Assurance

A. Referenced Codes and Standards: Comply with the following in accordance with Division

1. American National Standards Institute (ANSI)

A13.1 Scheme for the Identification of Piping Systems

Z535.1 Safety Color

B. National Fire Protection Association (NFPA)

13 Installation of Sprinkler Systems

99 Health Care Facilities

C. U.S. Department of Labor, Occupational Safety and Health Administration (OSHA)

29 CFR 1910	Subpart J, General Environmental Controls, including:
Paragraph 1910.144:	Safety Color Code for Marking Physical Hazards
Paragraph 1910.145:	Specifications for Accident Prevention Signs and Tags

Part 2 - Products

I. Approved Manufacturers

A. Products of indicated manufacturers are acceptable. No substitutions.

1. Seton Identification Products.
2. Brady Corporation.
3. Marking Services, Inc.
4. Brimar Industries, Inc.

II. Valve Tags

A. Construct or stamp from not less than No. 14 gage brass or aluminum and not less than 1 1/2 inches diameter.

B. Provide No. 10 gage brass "S" hook and brass chain to securely fasten valve tag to valve.

C. Permanently stamp and mark with service designation, normal valve position, and unique identifying number as large as possible. Assign unique number coordinated with service designations to each valve as indicated [and consistent with Owner's existing valve numbering system]. Coordinate with Owner’s Representative and Design Professional before finalizing the valve tag numbering system.

III. Steam Trap Tags

A. Construct or stamp from not less than No. 14 gage brass or aluminum and not less than 1 1/2 inches diameter. Approved Model: Brady B-907.

B. Provide No. 10 gage brass "S" hook and brass chain to securely fasten tag to steam trap.

C. Permanently stamp and mark with service designation and unique identifying number as large as possible.

IV. Piping System Markers

A. Identify accessible piping installed indoors with pressure-sensitive piping system markers with wraparound seals. Accessible piping shall include exposed piping, and piping located above lay-in ceilings, in crawl spaces, and in shafts. Markers shall include full system name, flow arrow, color code and pipe diameter. Abbreviated system names are not acceptable. Approved Model: Seton Opti-Code.

B. Identify piping installed outdoors with pressure-sensitive pipe marker applied to plastic base. Print marker with weather-resistant ink. Mount plastic base onto piping with color-coded plastic-coated wire. Approved Models: Pipe marker: Brady B-946.

C. Where pipes are too small or not readily accessible for application of pipe markers, securely fasten brass identification tag at least 1 1/2 inches in diameter, with depressed 1/2 inch high black letters and numerals, at locations specified for pipe markers.

V. Mechanical Equipment Markers

A. For each item of mechanical equipment, provide lettered and numbered nameplate, identifying equipment number and service. Stenciled equipment data is not acceptable. Nameplates: Aluminum with permanent 1 1/2 inch high white letters on black background, mechanically affixed and installed in readily visible location on equipment. Coordinate final equipment

designations with PGCPS. Coordinate nameplates to match PGCPS' existing equipment nameplates.

B. For each item of mechanical equipment, provide manufacturer's identification plate showing equipment name, manufacturer name and address, date of purchase, model number and performance data.

VI. Fire Protection Systems

A. Refer to [ ] Fire [Protection][Extinguishing] System: Section [ ].

VII. Color Continuity

A. Coordinate legends and colors to match those on existing systems as directed by PGCPS.

B. If no color coding system exists, comply with identification schedules indicated.

VIII. Identification Schedules

A. Legends, designations and colors for piping and equipment identification as indicated in Schedule of Identifying Legends and Colors. Print legends in uppercase letters, size as indicated in Schedule of Legend Letter Sizes.

SCHEDULE OF IDENTIFYING LEGENDS AND COLORS			
SERVICE	TAB LEGEND	BACKGROUND COLOR	LEGEND COLOR
Steam-High Pressure	S-[+]	Yellow	Black
Steam-Medium Pressure	S-[+]	Yellow	Black
Steam-Low Pressure	S-[+]	Yellow	Black
Atomizing Steam	AS	Yellow	Black
Soot Blower Steam	SBS	Yellow	Black
Boiler Feedwater	BF	Yellow	Black
Blowoff	BO	Yellow	Black
Intermittent Blowdown	IBD	Yellow	Black
Continuous Blowdown	CBD	Yellow	Black
Condensate-High Pressure	C-[+]	Yellow	Black
Condensate-Medium Pressure	C-[+]	Yellow	Black
Condensate-Low Pressure	C-[+]	Yellow	Black
Pumped Condensate-Pressure	PC-[+]	Yellow	Black
Safety Relief Vents	SRV	Yellow	Black
Diesel Engine Exhaust	DEE	Yellow	Black
Gas Engine Exhaust	GEE	Yellow	Black
Diesel Engine Cooling Ethylene Glycol/Water Solution Supply/Return	DECS/DECR	Yellow	Black
Draft Piping	DA	Yellow	Black

Fuel Oil Supply/Return	FOS/FOR	Yellow	Black
Gasoline	GASOLINE	Yellow	Black
Manufactured Gas	MG	Yellow	Black
Gas (Natural)	G	Yellow	Black
Propane	PROPANE	Yellow	Black
Instrument Air	IA-[+]	Blue	White
Domestic Cold Water	DCW	Green	White
Domestic Hot Water Supply	DHWS	Yellow	Black
Domestic Hot Water Return	DHWR	Yellow	Black
Laboratory Cold Water	LCW	Green	White
Laboratory Hot Water Supply	LHWS	Yellow	Black
Laboratory Hot Water Return	LHWR	Yellow	Black
Animal Drinking Water	ADW	Green	White
Well Water Supply/Return	WWS/WWR	Green	White
Raw Water	RW	Green	White
Softened Water	SW	Green	White
Safety Shower Water Supply	SSH	Green	White
Distilled Water Supply/Return	DWS/DWR	Green	White
Deionized Water Supply/Return	DIWS/DIWR	Green	White
Reverse-Osmosis Water Supply/Return	ROWS/ROWR	Green	White
USP Purified Water Supply/Return	USPS/USPR	Green	White
Water Treatment Chemical Feed Systems	CF	Green	White
Vacuum Cleaning	VC	Blue	White
Ash Conveying	ASH	Blue	White
Refrigerant Compressor Discharge	RD	Green	White
Refrigerant Liquid	RL	Green	White
Refrigerant Hot Gas	RHG	Green	White
Refrigerant Suction	RS	Green	White
Refrigerant Vent	RV	Green	White
Fire Protection Water	FPW	Red	White
Halon	HA	Red	White
Standpipe	SP	Red	White
Foam	FOM	Red	White
High-Pressure Carbon Dioxide	HCOX	Red	White

Low-Pressure Carbon Dioxide	LCOX	Red	White
Hot Water Heating Supply/Return	HWS/HWR	Yellow	Black
High-Temperature Hot Water Heating Supply/Return	HTHWS/HTHWR	Yellow	Black
Chilled Water Supply/Return	CHWS/CHWR	Green	White
Condenser Water Supply/Return	CWS/CWR	Green	White
Free-Cooling Water Supply/Return	FCWS/FCWR	Green	White
Ethylene Glycol/Water Solution Supply/Return	EGWS/EGWR	Green	White
Process Cooling Fluid (Syltherm HF)	PCF	Green	White
Humidification Water	HMW	Green	White
Humidification Steam-Low Pressure	HS-[+]	Yellow	Black
Heat Pump Water Supply/Return	HPWS/HPWR	Yellow	Black
Cold Water Makeup Supply	CWS	Green	White
Tower Makeup Water Supply	TWS	Green	White
Oxygen	O	Yellow	Black
Compressed Air	A	Blue	White
Breathing Air	BA	Blue	White
Vacuum	VAC	Blue	White
Nitrous Oxide	NOX	Blue	White
Nitrogen (Gas)	N(G)	Blue	White
Nitrogen (Liquid)	N(L)	Blue	White
Carbon Dioxide	COX	Blue	White
Clean Compressed Air	CA	Blue	White
Clean Steam-Pressure	CS-[+]	Yellow	Black
Clean Steam Condensate- Pressure	CSC-[+]	Yellow	Black
Water For Injection Supply/Return	WFIS/WFIR	Green	White
Gravity Condensate (from Cooling Coils)	GCC	Green	White
Pumped Condensate (from Cooling Coils)	PCC	Green	White
Rainwater Conductor	RWC	Green	White
Laboratory Waste	LW	Green	White
Laboratory Waste Vent	LWV	Green	White
Sanitary Waste	SAN	Green	White
Sanitary Waste Vent	VENT	Green	White

Radon Vent	RV	Green	White

+List System Nominal Pressure

SCHEDULE OF LEGEND LETTER SIZES

OUTSIDE DIAMETER OF PIPE INCLUDING INSULATION (INCHES)	LENGTH OF COLOR FIELD (INCHES)	SIZE OF LEGEND LETTERS AND NUMERALS (INCHES)
Under 1 1/2	8	1/2
1 1/2 to 2	8	3/4
2 1/2 to 6	12	1 1/4
8 to 10	24	2 1/2
Over 10	32	3 1/2

Part 3 - Execution

I. Installation

A. Apply piping system markers and valve tags at following locations:

1. Adjacent to each valve and fitting.
2. At each branch location and riser take-off.
3. At each side of pipe passage through floors, walls, ceilings and partitions.
4. At each pipe passage to and from underground areas.
5. Every 20 feet of run.

B. Provide arrow markers indicating direction of flow adjacent to each piping system marker. Use double-headed arrows if flow is in both directions.

C. Apply piping system markers where view is unobstructed. Markers and legends shall be clearly visible from operating positions.

D. Apply tags and piping system markers in accordance with manufacturer's written instructions. Do not attach tags to valve handle such that valve operation is hindered.

E. Submit compact disk containing valve, equipment, and steam trap schedules, logically grouped and identified by tag numbers. Spreadsheet software to be used for the schedules shall be Microsoft Excel. Submit six (6) hard copies with compact disk.

END OF SECTION

Part 1 - General

I. Summary (Non-inclusive)

A. Section Includes: Work of Mechanical Installer to prepare mechanical systems for Testing and Balancing Agency.

B. Construction Manager will engage independent Testing and Balancing (TAB) Agency for testing and balancing of mechanical systems. TAB work is described in Testing and Balancing of Mechanical Systems: Division 1.

II. Related Work Specified Elsewhere (Non-Inclusive)

A. Applicable Sections: Division 1.

B. Inspection and Testing Services: Division 1, refer to for contractual requirements to retain Agency.

C. Testing and Balancing of Mechanical Systems: Section 230593.

D. Instrumentation and Control Equipment: Section 230923.

E. Direct Digital Control (DDC) System: Section 230923.

F. DDC System Sequences of Operation: Section 230923.

G. Water Treatment: Section 232500.

III. Submittals

A. Submit per the requirements of Division 1.

B. Quality Control Procedures: Submit reports indicating compliance with indicated criteria:

1. Data Register: As indicated.
2. Testing and Balancing Schedule: As indicated.
3. Certifications: Work Completion.

Part 2 - Products

Not used.

Part 3 - Execution

I. General

A. Review Contract Documents and submittals to verify that piping, instruments, thermowells, valves, ductwork, dampers, measurement and control devices, and access openings have been provided in correct quantity and at correct locations to permit testing and balancing of air, steam and/or hydronic systems under various operating conditions.

B. Provide inlet vanes, V-belt drives, variable-frequency drives, initial fixed pitch sheaves or variable pitch sheaves for fans as indicated. Provide variable frequency drives as Work of Division 16. Replace variable pitch sheaves or initial fixed pitch sheaves with appropriate fixed pitch sheaves when

correct speed (rpm) has been determined by Testing and Balancing Agency. Deliver variable-pitch sheaves and initial fixed pitch sheaves to Owner's Representative. Notify TAB Agency upon completion of sheave replacement.

C. Inform TAB Agency regarding major deviations from Contract Documents made to systems during construction and furnish one (1) complete set of Record Drawings, showing presence and location of balancing elements, volume dampers, air extractors and instrument ports, prior to start of TAB work.

D. Provide indicated Work and submit certification that each operation indicated is complete and in accordance with Contract Documents. Accomplish this Work before TAB work can start. Within 30 days of notification by Owner of award of Testing and Balancing Contract, submit schedule to complete following Work:

1. Complete physical installation.
2. Pressure test air, steam and hydronic systems as required.
3. Clean, flush, fill and chemically treat steam and hydronic systems as required. Provide temporary startup strainers and replace with clean strainers after system cleaning as indicated.
4. Provide each air system with medium-efficiency disposable start-up filters. Replace filters one (1) time during construction. Replace with new specified filters upon acceptance of each system by Owner's Representative. Install HEPA filters, where indicated, upon acceptance of each system by PGCPS.
5. Test and operate prime movers, including fans, pumps, chillers and boilers, at full design load to verify adequate power, proper rotation, completed controls, operational auxiliaries, and complete overall installation.
6. Balance rotating equipment statically and dynamically.
7. Secure linkages.
8. Properly evacuate air from liquid systems. Install air vents at coils and at high points in systems whether or not expressly indicated, and verify that they operate properly. Verify that expansion tanks are filled and in proper working order.
9. Verify that automatic control valves are in proper working order and location, that they are marked and installed with correct "NORMAL" positions as required, and that hand valves and balancing valves are positioned for full flow through equipment.
10. Verify that automatic control dampers are in proper working order and location, that they are marked and installed with correct "NORMAL" positions as required. Verify that balancing and shut-off dampers are positioned for full flow. Verify that equipment, terminal devices and distribution systems are completely and properly connected.

E. For each item of mechanical equipment, submit typed Data Register in non-yellowing, clear plastic binder, and securely attach it to associated equipment. Show operating temperature, pressure, flow rate, amperage, voltage, phase, frequency (Hz), rpm and brake horsepower, as appropriate.

F. Deliver to TAB Agency, for use until TAB work is complete, flow-indicating devices intended for use with permanently installed primary flow measuring devices. Calibrate permanently-installed flow measuring devices and associated display instruments, thermometers, sensors and pressure gauges. Deliver documentation to TAB Agency to verify calibrations.

G. Submit schedule stating when each system is ready for TAB work to begin. Separate schedule by building, building area, building floor and mechanical system, as required. Submit schedule within 30 days of Contract Award. Update schedule at least two (2) months in advance of scheduled start of TAB work.

H. Attend coordination meetings between TAB Agency, and PGCPS, conducted under guidance of Construction Manager. First meeting is approximately two (2) weeks before scheduled start of TAB work, as scheduled by Mechanical Installer and approved by PGCPS.

I. Provide labor, material, tools and equipment to operate mechanical equipment and systems during TAB work, and for required adjustments, calibrations and repairs of automatic control devices or their components. Provide these services on each working day and without undue delay, as required by TAB Agency. Protect and operate equipment and systems during TAB work.

J. When requested by TAB Agency, contractor shall furnish services of personnel to accompany TAB Agency when TAB work is being performed.

K. Make modifications at no additional cost and to satisfaction of PGCPS to rectify discrepancies reported by TAB Agency indicating non-compliance with Contract Documents.

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract requirements, Division 1 - General Requirements, Section 230100 - General Provisions and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope
   A. The testing, adjusting and balancing of the air distribution systems, hot water heating systems chilled water cooling systems and condenser water systems, are specified under the Division 1 General Requirements.
   B. The installers shall give notice when the systems are ready for testing, adjusting and balancing, and give assistance in adjusting and correcting deficiencies.

III. Quality Assurance
   A. Tab Firm Qualifications:
      1. The TAB Firm shall be Certified in Testing, Adjusting and Balancing of Air and Hydronic Systems by one of the following:
         a) AABC
         b) NEBB
      2. Provide documentation confirming qualifications, successful experience. TAB contractor shall have a minimum of 5 (five) years experience.
   B. TAB Firm shall submit 2 copies of the firm's AABC/NEBB TAB Certification.
   C. When requested, the TAB Firm shall furnish a Certificate of Conformance Certification.
   D. TAB Report Forms: Prepare report forms in accordance with the requirements from PGCPS building services.
   E. Instrumentation Calibration: Calibration of instruments shall be in accordance with the current edition of the AABC/NEBB Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

IV. Submittals
   A. Qualification Data: When requested, submit 2 copies of evidence that TAB firm and this Project's TAB team members meet the qualifications specified in Sub-section 1.3 TAB Firm Qualifications.
   B. TAB Agenda: When requested, submit 2 copies of the TAB Agenda. Include a complete set of report forms intended for use on this Project.

C. Certified TAB Reports: Submit a final TAB report in accordance with the current edition of the NEBB Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

Part 2 - Products

I. SHEAVES AND BELTS

A. The installer shall be responsible for providing and installing new fan or motor sheaves and belts when required to obtain the designed airflow.

II. AIR FILTERS

A. The installer shall be responsible for providing and installing new, clean, air filters. Filters shall be installed before final inspection and before giving notice for the testing, adjusting and balancing.

Part 3 - Execution

I. Giving Notice To Proceed

A. It shall be the responsibility of the installers to properly install, inspect and assure proper operation of each individual component of the system before giving notice to proceed with the testing, adjusting and balancing. The testing, adjusting and balancing shall not be performed until all mechanical equipment is properly installed and is 100 percent operational, all temperature controls are installed and calibrated and all systems are cleaned and clean filters installed.

B. The mechanical contractor shall set all outside air dampers to the approximate minimum position during equipment installation and prior to start-up of equipment.

C. The Balancing Contractor shall be responsible for properly plugging test holes which were made for testing purposes. Plugs shall be made of rubber and shall be sized to fit testing holes.

II. Correction Of Deficiencies And Assistance

A. The installers shall assist in the testing, adjusting and balancing the systems, shall adjust the system and make corrections of any deficiencies found such as: motor starters and horsepower; improper sheave and belt sizes; missing, improperly installed or malfunctioning volume control dampers, air extractors, air terminals, air monitors, variable or constant volume boxes, power wiring, controls and any other items that prevent the completion of the testing, adjusting and balancing of the systems.

B. Airflow values shall not exceed +/-10% of scheduled values on contract documents. Installer shall be fully responsible for addressing any deficiencies outside of this tolerance range. TAB contractor shall provide two (2) copies of final reports verifying that tolerance range has been met on all balanced equipment.

III. Additional Material

A. Any additional items or material required to be installed in the ductwork system to implement the testing, adjusting and balancing shall be furnished under Division 1 - General Requirements along with the location. The installers shall install these items or materials.

IV. Commissioning Responsibilities

A. This contractor shall be responsible for participation and coordination with the commissioning process.

END OF SECTION

Part 1 - General

I. General

A. The Bidding and Contract Requirements, Division I - General Requirements, Section 230100 - General Provisions and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope

A. The work covered under this section shall include providing and installing the insulation on the items listed in this section or as shown on the drawings.

III. Quality Assurance

A. All insulation shall have a composite fire hazard rating as tested by ASTM E-84, NFPA 25 or UL 723 not to exceed 25 flame spread, 50 smoke developed, and 50 fuel contributed.

IV. Submittals

A. Provide shop drawings on proposed insulation as described in section.

Part 2 - Products

I. General

A. The manufacturer of the products specified in this section shall be one of the following:

1. Mineral Fiber (Fiberglass and Rock Wool)

a) Johns Manville

b) CertainTeed

c) Knauf

d) Owens-Corning

2. Cellular Glass

a) Pittsburgh-Corning.

3. Calcium Silicate

a) Industrial Insulation Group

4. Ceramic Fiber

a) The Carborundum Company

b) C-E Refractories

c) 3M

d) Thermal Ceramics

e) Premier Refractories and Chemicals

f) Nelson Firestop Products.

5. Elastomer

a) Armacell

b) Nomaco

6. Fire Wrap

a) Unifrax

7. Metal Jackets

a) Childers

8. Mineral Fireproofing

a) USG Acoustical Products Company

9. Mineral Wool Felt

a) Fiberex

b) US Gypsum

c) Roxul

10. Thermal Insulating Wool

a) Owens-Corning

11. Jackets, Adhesives, Mastics, Sealing Tapes and Accessories

a) Armacell

b) Foster

c) Childers

d) Compac

e) Epolux

f) Kinetics/Peabody Noise Control

g) Hamfab

h) Industrial Insulation Group

i) Johns Manville

j) Owens-Corning

k) Pittsburgh-Corning

l) U.S. Gypsum

m) Ceel-Co

n) General Aluminum Supply Corporation

o) Pipe Shields, Inc.

p) Precision

q) Proto

r) Sound Seal/United Process

s) TCI Industries.

t) FlexClad

B. Specific manufacturer's products are cited in the following paragraphs to establish the desired quality and performance of Work. Equivalent products by the other acceptable manufacturers indicated are acceptable.

II. Piping Insulation

A. The piping shall be insulated with heavy density rigid molded fiberglass pipe insulation with factory applied all service jacket (ASJ) with a 'K' factor not to exceed .25 @ 75 deg. F mean temperature. The minimum insulation thickness for the various items shall be as follows:

1. Domestic Cold Water Piping and Cold Water Makeup Piping - 1/2". Exceptions: Exterior walls and plumbing chases shall be 1".

2. Trap Primer Supply Piping - 1/2" elastomeric, expanded closed cell, seamless pipe insulation from the drain tap to the trap primer valve or distribution unit.

3. Domestic Hot Water, Tempered Water and Hot Water Recirculating Piping -1". Exceptions: Fixture runouts in interior plumbing chases and walls may be 1/2".

4. Storm Water (includes main and overflow piping) - The horizontal section of the rain leaders, riser to and including the interior part of the roof drains shall have 1" of insulation. The drain body and sump receiver of the roof drain shall have 1” of rigid fiberglass board insulation.

Above slab piping serving open site drains shall have 1” pipe insulation from the open site drain to the rain leader.

5. Hot Water Heating Supply and Return
   a) Pipe Size 1-1/2” and Under - 1".
   b) Pipe Size 2” and larger - 2".
6. Chilled Water Supply and Return
   a) Pipe Size 3” and under – 1 ½”
   b) Pipe Size 4” and larger – 2”
7. Condenser Water Supply & Return – 1-1/2”.
8. Condensate Piping - 1".
9. Refrigerant Piping - 1" closed cell, semi-slit pipe insulation with a composite fire hazard rating as tested by ASTM E-84 not to exceed 25 flame spread and 50 smoke developed. Prototype: ARMSTRONG Armaflex AP.
10. Domestic water piping in the cells of masonry walls shall have be polyolefin pipe insulation such as “IMCOLOCK” with a ½ inch wall thickness.
11. Where chilled/hot water piping is installed within the airstream of mechanical equipment, piping shall be insulated with flexible closed cell elastomeric pipe insulation. Insulation thickness shall be 1 inch.

B. Sheet Metal Saddles - See section 15050 - 2.03.

C. Finish - Exposed Piping - Cover with 8 oz. canvas jacket.
   1. Exposed piping in the kitchen shall be insulated per the specification and covered with a PVC jacket 20 mil thick, white in color, washable and approved by the USDA and the FDA.

III. Piping, Fittings, Valves And Specialties Insulation

A. Fittings, valves and specialties for the piping systems shall be insulated by two-piece molded fiberglass fittings with an insulating value equivalent to the pipe insulation. Acceptable alternative insulation methods shall be as described in paragraph 3.02 D.

B. The following piping, fittings, valves, and specialties shall be insulated.
   1. Domestic cold water piping
   2. Domestic hot water, tempered water and hot water recirculating piping
   3. Hot water heating supply and return
   4. Chilled water supply and return
   5. Condensate piping
   6. Condenser Water Supply & Return

C. Finish - Insulation on exposed piping fittings, valves and specialties shall be covered with an 8-oz. canvas jacket.

IV. Equipment Insulation

A. Chilled Water Pump, Chilled Water Standby Pump, Cooling Tower Pump and Cooling Tower Standby Pump- Pumps shall be encased with a sectional fabricated, flanged insulated split metal housing to provide ease of maintenance without damage to the insulation. Housing shall incorporate integral latching devices. Housing shall be tight sealing to prevent air infiltration. See drawing detail. All internal surfaces shall be insulated with 6 pounds per cubic foot density fiberglass board having a “K” value of 0.22@ 75 Deg F mean temperature with a factory applied all service jacket (ASJ). Minimum insulation thickness shall be one inch.

B. Chiller Cooler and Chilled Water Air Separators - All cold surfaces shall be insulated with one inch thick fiberglass insulation. 'K' factor shall not exceed 0.27 @ 75°F mean temperature with a density of 6.5 pounds per cubic foot. Chilled and hot water expansion tanks are not required to be insulated.

C. Finish - All insulation on chiller cooler and chilled water air separator shall be covered with an 8-oz. canvas jacket.

V. Ductwork Insulation

A. Concealed Rectangular and Round Supply/Return, including flexible connections (horizontal FCU’s) And Outside Air Ductwork - Unless noted otherwise on the drawings shall be insulated with fiberglass duct wrap insulation at 1 pound per cubic foot density, having a facing of laminated composite aluminum foil and kraft paper reinforced with a glass reinforcing, with a perm rating not exceeding .05. The 'K' value shall not exceed .29 @ 75 degrees F mean temperature. The duct wrap insulation shall have a minimum thickness of 2 inches. Insulate flexible connections on horizontal fan coil units.

B. Exposed Rectangular Supply/Return and Outside Air Ductwork - Unless noted otherwise on the drawings shall be insulated with 6 pounds per cubic foot density fiberglass insulating board having a facing of laminated composite aluminum foil and kraft paper reinforced with a glass reinforcing with a perm rating not exceeding .05. The 'K' value shall not exceed .23 @ 75°F mean temperature. The duct board shall have a minimum thickness of 1-1/2 inches. Exposed ductwork shall include but is not limited to, ductwork in accessible attics, equipment mezzanines, boiler rooms and equipment rooms. The exposed rectangular supply/return and outside air ductwork shall also be covered with a canvas cover and prepared for painting.

C. See Section 15810 for description of any additional ductwork that shall be lined.

Part 3 - Execution

I. General

A. All insulating material shall be installed in accordance with the manufacturer's recommendations by personnel regularly employed in the pipe, duct and equipment insulating trade.

B. The insulation shall not be applied until all surfaces are clean and dry and until inspected and released for insulation application.

C. A complete moisture and vapor seal shall be provided on cold surfaces where vapor barrier jackets or coatings are required. Anchors, hangers, and other projections shall be insulated and vapor sealed to prevent condensation.

D. Pipe or duct insulation shall be continuous through walls and floor openings except where walls or floors are required to be fire stopped or required to have a fire resistance rating.

II. Pipe Insulation Application

A. Pipe insulation shall be installed in accordance with the manufacturer's instructions.

B. Piping (except refrigeration piping) - Butt all joints firmly together. Ends of pipe insulation shall be sealed off with a vapor barrier coating at all fittings and valves. The insulation laps and butt strips shall be sealed by one of the following methods:

1. Insulation without self-seal laps shall have lap adhesive manually applied to all laps and butt strips. Stapling is not acceptable.
2. Insulation with self-seal laps shall have lap adhesive manually applied to the outside of all laps and butt strips after installation. Stapling is not acceptable.

C. Refrigeration Piping and domestic water piping using closed cell insulation – Butt joints and seams shall be joined together with contact adhesive Prototype-Armstrong 520 or manufacturer’s recommended adhesive. Both surfaces to be joined shall be coated with the adhesive.

D. Fittings and Valves - Shall be insulated with molded fiberglass fittings, segments of pipe covering, or with firmly compressed foil faced fiberglass blanket. Mitered joints are not acceptable. Secure in place with 20 gauge corrosion resistant wire and apply a smoothing coat of insulating cement. Vapor seal by applying a layer of open weave glass cloth fabric embedded between flood coats of vapor barrier mastic. Lap glass fabric 2 inches onto adjacent pipe. PVC covers are acceptable only if the item covered is fully insulated first. Insulation shall be installed so the cover cannot be deformed. Contractor shall request an inspection by the Owner of the insulated items prior to cover installation.

E. Finish - All exposed piping, and piping fittings, valves and specialties insulation shall receive an 8 oz. canvas jacket smoothly pasted in place with lagging adhesive and sized with one brush coat of lagging adhesive. The finished surface shall be suitable for painting. Exposed piping includes piping in accessible attics, equipment mezzanines, boiler rooms and equipment rooms.

F. Outdoor Piping - Weatherproofing Finishes for All Outdoor Insulation.
   1. Piping - Apply aluminum metal jacket 0.016" with moisture barrier around pipe and slip edge into preformed Z lock positioned to shed water. Butt next jacket section leaving approximately 3/8" gap. Place preformed 2" butt aluminum band and wing seal.
   2. Fittings - Apply prefabricated metal fittings in composition to pipe jacketing.

G. Sheet Metal Saddles shall be provided and installed on all pipe hangers as stated under section 15050, 2.03.

H. Pipe Insulation Support - All insulated piping shall be supported at hanger and sleeve locations by either using a high density pipe insulation or wooden blocking, installed inside the vapor barrier for all pipe sizes one inch and larger. High-density pipe insulation shall be of the type as recommended by the manufacturer and shall be substituted for no less than the bottom half section of the fiberglass pipe insulation. The lengths of the high-density insulation shall be at least two inches longer (each end) than the length of the saddle. The lengths of wooden blocking shall be eight inches. Wooden blocking shall be the same thickness as the pipe insulation, the same width as the pipe, shall be tapered within the insulation and shall be centered at the hanger. Remove portions of the fiberglass pipe insulation by peeling back the factory applied all service jackets from the insulation and cut out and replace the required sections for either method of insulation support. Re-wrap the vapor barrier to completely enclose the installation. Manually apply lap adhesive to the outside lap and apply butt strips. The installations shall also meet any additional requirements recommended by the insulation manufacturer.

I. Underground Pipe Insulation

1. Insulation- insulation shall be cellular glass insulation manufactured in accordance with ASTM C 552. The insulation shall be fabricated in half sections wherever possible. For large diameter piping where half sections are not practical, curved sidewall segments are permitted.
2. Jacketing- a 50 mil (1.3mm) thick self-sealing, modified bituminous membrane reinforced with a glass fabric, and a 1mil (0.3mm) aluminum top film on the outer surface.
3. Mastic- shall be asphalt cutback mastic.
4. Reinforcing Fabric- shall be open mesh polyester fabric with 6x5.5 mesh/inch configuration.
5. Sealant- shall be a non-setting butyl sealant.
6. Banding- shall be ½ inch aluminum or fiberglass reinforced nylon for insulated lines with OD's of 48 inches or less.

III. Equipment Insulation Application

A. Chiller Cooler and Chilled Water Air Separators - Shall be insulated with fiberglass insulation cut to a smooth uniform fit with butting edges. Complete installation shall not have wrinkles, bulges or overlapping edges. Secure insulation to all surfaces with adhesive designed for that purpose.

B. Finish - All insulation on chilled water chiller cooler and chilled water air separator shall be covered with an 8-oz. canvas jacket installed as described in paragraph 3.02 D.

IV. Ductwork Insulation Application

A. Fiberglass Duct Wrap Insulation - The duct wrap insulation shall be secured to the ductwork with fire retardant adhesive in sufficient quantities to prevent sagging. Ducts with a width of over 30" shall be further secured on the underside with mechanical fasteners on 18" maximum centers. Insulation shall be butted with facing overlapping all joints at least 2" and sealed with fire retardant vapor barrier adhesive. Seal all breaks and punctures with vapor barrier tape and same type of fire retardant adhesive. Stapling is not acceptable.

B. Fiberglass Insulating Board Application

1. The insulating board shall be secured to the ductwork with mechanical fasteners. The fasteners shall be spaced 12" to 18" on center with a minimum of two rows per side of duct. Secure insulation in place with washers firmly embedded in insulation. Seal all joints, breaks and punctures with fire retardant vapor adhesive reinforced with a 3" wide strip similar to that of facing.
2. Finish - A glass cloth shall be applied over the facing into a wet coat of fire retardant adhesive, overlapping seams at least 2". Apply finish coat of same fire retardant adhesive.

END OF SECTION

Part 1 - General

I. General

A. The Bidding and Contract Requirements, Division 1 - General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

B. The objective of commissioning is to provide documented confirmation that each facility fulfills the functional and performance requirements of Prince George's County Public Schools. To reach this goal, it is necessary for the commissioning process to establish and document the following:

1. Owner's Project Requirements (OPR), which are a criteria for system function, performance, and maintainability (design intent);
2. Compliance with OPR throughout design, construction, start-up, and the initial period of operation.

II. Scope

A. The Commissioning Agent (CxA) will serve as an objective advocate of the owner, oversee and coordinate the commissioning process, and present final recommendations to the owner regarding the performance of the commissioned building systems.

B. The primary tasks of the CxA during the overall Design Stage is to review the design to ensure it meets OPR and develop detailed commissioning specifications.

C. During construction, the CxA coordinates the execution of a testing plan, which includes observing and documenting all systems' performance to ensure that the systems are functioning in accordance with the OPR and the contract documents.

D. The CxA is not responsible for design or general construction scheduling, cost estimating, or construction management, but may assist with problem-solving or resolving non-conformance issues or deficiencies.

III. Quality Assurance

A. The roof drainage system shall be tested for leaks before the insulation is applied and before the piping is covered up. The test shall be filling the system with water.

B. LEED Requirements:

1. The CxA shall be involved throughout the project from design development through the warranty phase.
2. The CxA will provide commissioning services required by LEED for Schools - 2007 (or current version).

3. The CxA works in conjunction with the project design team through the design process, prepares a commissioning plan, and a Final Commissioning Record to meet the requirements of the LEED Energy & Atmosphere commissioning credits.

IV. Submittals

A. Provide full commissioning reports to PGCPS upon completion for all required equipment and/or systems..

Part 2 - Products (None)

Part 3 - Execution

I. Design Stage: The CxA shall perform the following duties during the design stage of the project:

A. Assemble initial commissioning team, hold a scoping meeting and identify responsibilities.

B. Review the Preliminary Commissioning Plan developed by PGCPS during the Planning Phase and fill in additional detail including team member responsibilities & directory, communication structure, specific systems & equipment to be commissioned and commissioning process schedule.

C. Schedule and lead commissioning meetings as needed with the Commissioning Team

D. Coordinate the commissioning work during design.

E. Review Owner's Project Requirements & Basis of Design documentation for clarity and completeness.

F. Perform focused reviews of the design, drawings and specifications at each stage of development (Pre-DD, 35%, 65%, & 99% review meetings).

G. Assist and review the development and updating of the PGCPS' Project Requirements and Basis of Design by design team members after each design review submission.

H. Update the Commissioning Plan in preparation for Construction Stage.

I. Develop full commissioning specifications for all commissioned equipment. Coordinate this with the architect and engineers and integrate the commissioning specifications into the overall project specification package, normally Sections 01910 and 15995; with Section 16995 open if required.

1. The commissioning specification will include general commissioning requirements common to all systems and assemblies and a detailed description of the responsibilities of all parties, details of the commissioning process; reporting and documentation requirements, including formats; alerts to coordination issues,

deficiency resolution; construction checklist and start-up requirements; the functional testing process; specific functional test requirements, including testing conditions and acceptance criteria for each piece of equipment being commissioned.

2. The specifications will clearly indicate who is witnessing and documenting start-up of each commissioned system. The specifications will be clear as to who is writing, directing, conducting and documenting functional tests and regulatory-required tests. This may vary between systems, especially between electrical and mechanical. Provide language to enhance current project specifications to ensure comprehensive controls submittals, full control contractor accountability for documented point-to-point checkout and commissioning participation, comprehensive test, adjusting and balancing, full contractor documentation of start-up and superior training and O&M manual documentation.

J. Coordinate a controls integration meeting where the electrical engineers, mechanical engineers, PGCPS representatives, and the CxA discuss integration issues between equipment, systems and disciplines to ensure that integration issues and responsibilities are clearly described in the specifications.

K. Review the recommendations from the constructability review for commissioning and O&M issues.

L. Write step-by-step functional test procedures and documentation formats for all commissioned equipment and assemblies. Test procedures will include manual functional testing, energy management control system trending and may include stand-alone data-logger monitoring.

II. Construction Stage: The CxA shall perform the following duties during the construction stage of the project:

A. Coordinate and direct the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, frequently updated timelines and schedules and technical expertise.

B. Plan and conduct commissioning meetings as needed and distribute minutes. Once project has successfully been bid and awarded conduct a commissioning kick-off meeting to provide an overview of the commissioning process, establish lines of communications, and review timelines and schedules.

C. Coordinate the commissioning work with the design team, PGCPS Mechanical Division, and construction manager, to ensure that commissioning activities are being incorporated into the master schedule.

D. Revise, as necessary, the construction phase commissioning plan developed during design, including scope and schedule.

E. Request and review additional information required to perform commissioning tasks, including O&M materials, contractor start-up and checkout procedures. Before start-up, gather and review the current control sequences and interlocks and work with contractors and design engineers until sufficient clarity has been obtained, in writing, to be able to write detailed testing procedures.

F. Review submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with the design team and Construction Manager reviews.

G. Write and distribute construction checklists for commissioned equipment.

H. Develop an enhanced start-up and initial systems checkout plan with contractor input for selected equipment.

I. Perform site visits, as necessary, to observe component and system installations. Attend selected planning and job-site meetings to obtain information on construction progress. Review construction meeting minutes for revisions/substitutions relating to the commissioning process.

J. Witness HVAC piping pressure test and flushing, sufficient to be confident that proper procedures were followed. Include testing documentation in the Commissioning Record.

K. Witness any ductwork testing and cleaning sufficient to be confident that proper procedures were followed. Include documentation in the Commissioning Record.

L. Document construction checklist completion by reviewing completed construction checklists and by selected site observation.

M. Document systems start-up by reviewing start-up reports and by selected site observation.

N. Approve air and water systems balancing by spot testing and by reviewing completed reports and by selected site observation.

O. Coordinate functional testing for all commissioned systems and assemblies. Witness and document manual functional performance tests performed by the Construction Contractor for all commissioned systems and assemblies, except:

1. Some smaller equipment may be tested and documented by the Construction Contractor at the Commissioning Agent's discretion,
2. Electrical equipment testing and regulated testing may be directed and documented by the Construction Contractor with only spot witnessing and report review by the Commissioning Agent.

P. The functional testing shall include operating the system and components through each of the written sequences of operation, and other significant modes and sequences, including start-up, shutdown, unoccupied mode, manual mode, staging, miscellaneous alarms, power failure, security alarm when impacted and interlocks with other systems or equipment. Sensors and actuators shall be calibrated during construction check listing by the installing contractors, and spot checked by the commissioning authority during functional testing. Analyze functional performance trend logs and monitoring data to verify performance. Coordinate retesting as necessary until satisfactory performance is achieved.

Q. Functional testing shall be done using conventional manual methods, control system trend logs, and readouts or standalone dataloggers, to provide a high level of confidence in proper system function, as deemed appropriate by the Commissioning Agent and PGCPS.

R. After manual testing and initial trouble shooting is complete, monitor system operation and performance for selected data points for up to two weeks by requesting trend logs from the Construction Contractor from the building automation system. For needed system points not able to be trended by the building automation system, furnish and install temporary portable data loggers that will monitor up to 20 points. Analyze monitored data to verify operation and performance and issue a written report. This time frame and monitoring points may be modified to accurately commission the building.

S. Verify the following specific EMS operations and/or programming functions
   1. Building has been zoned according to design and includes associated equipment
   2. Operational schedules are set; prove modifications can be performed
   3. Overrides are functional for Zones (via touch-screen), Individual Equipment, and Outdoor Air Dampers
   4. Warm-up/cool-down and night set-back routines are accurately programmed and functional
   5. Alarms are proven for incoming power failures (EMS & Security) and critical mechanical operations.

T. Review and verify the delivery and accuracy of the following EMS items:
   1. Control As-Built documents are complete (electronic and paper form)
   2. EMS program and database installed on CD/DVD and PGCPS Energy Management laptop
   3. Graphics are complete and floor plans are color coded per zone
   4. Software manuals are delivered and EMS training is performed for PGCPS Energy Management and Building Services personnel

U. Maintain a master issues log and a separate record of functional testing. Report all issues through the Construction Manager and PGCPS Mechanical Division as they occur. Provide through the Construction Manager written progress reports and test results with recommended actions.

V. Review the O&M manuals for commissioned equipment.

W. Compile a Commissioning Record, which shall include:
   1. A brief summary report that includes a list of participants and roles, brief building description, overview of commissioning and testing scope, and a general description of testing and verification methods.
   2. All outstanding non-compliance items shall be specifically listed. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc. shall also be listed. Each noncompliance issue shall be referenced to the specific functional test, inspection, trend log, etc. where the deficiency is documented.
   3. Also included in the Commissioning Record shall be the commissioning plan, PGCPS' Project Requirements, Basis of Design, commissioning specifications, design review, submittal review, issues log, construction checklists, CxA site visit and Commissioning Team meeting minutes, O&M review, test procedures and test data reports.
   4. Submit 3 bound text copies of the Commissioning Records with 3 CD copies including all information listed above.

END OF SECTION

Part 1 – General

I. General
   A. The Bidding and Contract Requirements, Division l - General Requirements, Section 230100 - General Provisions and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope: The work covered under this section of the specifications shall include:
   A. Design Considerations
   B. Technical Considerations
   C. General Requirements
   D. Zones
   E. Temperatures and Set Point
   F. Schedules
   G. Sequences
   H. Graphics
   I. Direct Digital Building System Components
      1. Wiring, Conduits, and Panels
      2. Control Dampers
      3. Control Valves
      4. Variable Frequency Drives (VFD)
      5. Instrumentation and Control Devices
   J. Training

III. Quality Control and Technical Considerations
   A. LEED, IECC Compliance items planned for the project shall be approved by PGCPS before specifications are completed.
   B. See “GENERAL REQUIREMENTS” in PART 2 of this section for addition design and technical considerations before developing the automatic temperature control system (ATC) for each project.
   C. ATC contractor is required to have at least 50 employees within construction and service. Employees must work for the controls division.
   D. ATC contractor at a minimum must have 4 employees with Niagara 4 certification. All technicians working on the PGCPS server must be Niagara 4 certified. ATC contractor shall submit certifications to PGCPS.
   E. ATC contractor must be approved by PGCPS controls division prior to contract award.

F. ATC contractor must self-perform all ATC work including but not limited to electrical installation.

G. ATC contractor must have a service department with 24/7 response.

Part 2 - Products

I. General Requirements

A. The ATC system shall be a Direct Digital Control (DDC) system.

1. The controls system shall utilize a single software platform (Use of a secondary system for controller configuration shall be unacceptable.
2. Tridium Niagara 4 Framework Titan 8000 (open-protocol and open NIC ONLY) specific controllers only. This shall include supervisory and unitary controllers.
3. All controllers, both supervisory and unitary (unit controllers) must be programmable. No configurable controllers will be accepted by PGCPS.
4. All Controllers are to be BTL (BACnet Testing Laboratories) Certified.

B. The complete system shall be warranted for a period of two (2) years from the date of substantial completion. A comprehensive test, evaluation, training and follow-up program shall be specified by the engineer to ensure that the system operates as designed over the life of the system during warranty period and beyond. Minimum training and follow-up program is specified in PART 3 of this section.

C. All software updates available for the ATC system during the warranty period shall be installed and tested to ensure proper operation at no extra cost to PGCPS.

D. Contractor shall not proceed with work involving interfacing with an existing controls system prior to written direction and approval by PGCPS Energy Management Department.

E. The ATC system in all schools shall be open protocol BACNET connecting back to the existing Tridium front end at the PGCPS Facilities Command Center, on Brown Station Road.

1. NOTE: Sole sourced DDC Controllers with proprietary software and programming requirements will not be approved by PGCPS for installation. Specify that the ATC contractor shall not order any controllers prior to approval from PGCPS and design engineer.

F. Programming for all devices (supervisory and unitary) shall use Niagara software only; “wizards” and plug-ins are NOT acceptable. All programming language and graphics

shall be the same software package shall be considered non responsive and will not be accepted.

G. All software and hardware shall be licensed directly to PGCPS.

H. All software, hardware, and training must be able to be purchased from several vendors. Branch only purchases will not be accepted.

I. PGCPS shall have the ability to be self-sufficient with regards to installation and programming of all software and hardware.

J. Each DDC controller shall communicate over a BACNET communications bus installed between the controllers by the ATC subcontractor. A communications master control panel shall be provided by the ATC subcontractor. This panel shall:

1. Provide PGCPS personnel with a convenient location to obtain system information using a laptop or a hand-held terminal. The hand-held terminal shall be available from more than one manufacturer as a standard product. School staff shall have (for read only) access to the system.
2. Collect ATC information and transmit it to the main ATC panel.
3. Receive energy management directions from the main ATC panel.
4. Have a lockable box installed inside the ATC panel with all site backups on a flash drive inside.

K. Within 10 working days of contract award, a meeting shall be scheduled with PGCPS, the Design Engineer, the General Contractor, the Controls Contractor, the Equipment Manufacturer, and the Commissioning Agent where applicable. The purpose of the meeting will be to review the sequences shown on the contract drawings, points list's, and interfaces necessary to reduce the number of issues and operational concerns. At completion of job a backup copy of the whole station; i.e. program is to be made. At completion of project, provide a copy of complete program on CD to be sent to PGCPS.

L. Two-pipe systems will require a Heating/Cooling switchover software point for equipment reference. Piping switchover will occur with manual hand valves. Automatic control valves for heating/Cooling piping switchover will not be accepted.

M. In the event an existing ATC system is being removed, the Contractor shall remove all wiring and other equipment and all old input/output (I/O) points associated with that system from all associated servers. PGCPS shall have first salvage rights for all equipment being removed.

N. All controllers, sensors, and switches shall be hard-wired. All connections between the main ATC panel and sub-panels/controllers shall be hard-wired. All electrical conduit

and wire installation as it pertains to the ATC system shall be performed by the ATC contractors' employees. Subcontractors will not be accepted. All Wiring that pertains to the DDC system shall be the sole responsibility of the ATC Contractor. Wiring shall be installed in accordance with Building and Electrical codes as well as any other applicable codes.

O. All cable splices when allowed are to be under terminal stripe.

P. All equipment shall have a Relay-In-Box (RIB) switch relay override for service and troubleshooting.

Q. Flat plate type sensors, not thermostats, shall be used to read temperature in spaces and shall have a range of 40° F to 100° F.

R. All equipment (with the exception of Boilers and Chillers) shall be capable of stand-alone DDC Function in the event of a network failure. These controllers shall be provided, and field installed by the ATC contractor. Factory controllers will not be acceptable.

S. The data transmitted from the ATC system to the Command Center shall include the following, as a minimum:

1. Equipment Information:
    a) Start/Stop signals for all equipment
    b) Summer/Winter single point switch-over capability
    c) Adjustable reset schedules
2. General Information:
    a) HWS Temperature
    b) HWR Temperature
    c) CWS Temperature
    d) CWR Temperature
    e) Glycol Temperature
    f) Geothermal Water Temperatures
    g) Outside Air Temperature
    h) Status and Flow for all Pumps
    i) Cooling Tower Status
    j) Alarm Data
3. Zone Information:
    a) All true Fan status (On/Off/Speed):
        (1) Read differential pressure for water

(2) Read status and safeties for air

b) Zone Temperature as measured by Zone Sensor

c) Override Status

d) Alarm Data (i.e. readings outside of normal system parameters)

(1) Temperature ± 10° from set point for ½ hour

e) CO_2 Level of Zones (See Section II, Paragraph E)

f) Return Air Temperature for Zones with constant volume and variable volume Air Handling Units.

g) Discharge Air Sensors on all equipment

h) Equipment Status (Default/Open/On/Off)

II. Zones

A. Buildings shall be divided into zones based on space utilization (i.e. media center, gym, etc.) and load requirements (i.e. classroom wing on North side). Consult with the PGCPS Mechanical Systems Department at the Design Development stage for final determination of zones.

B. Should adjoining zones be connected by a movable partition, particular care shall be taken to preclude short cycling when the partition is open.

C. The four basic schemes of zone control shall be:

1. Occupied Heating
2. Occupied Cooling
3. Unoccupied Heating
4. Unoccupied Cooling

D. Push button override switches shall be provided in the Administration zone to initiate an adjustable occupied mode when the zone is in an unoccupied mode. This mechanism shall be capable of extending the occupied mode in one hour increments up to three total hours. The push button switch shall be located in a controlled space and a local annunciator light shall be provided to indicate the override status. Override for all other zones shall be scheduled through the PGCPS Energy Management Department.

E. Large zones with constant volume HVAC systems and variable occupancy shall incorporate return air CO_2 sensors which shall, during the occupied mode, modulate the outside air damper(s) to maintain air quality in accordance with the latest version of ASHRAE Standard 62. These sensors shall be self-testing; i.e. upon failure of a sensor, the outside air damper(s) shall move to the position which provides the required outside air without reference to the CO_2 content of the ventilated space. The DDC system shall

have the capability to override this sensor and to provide the required outside air inside without reference to CO_2 contents of the ventilated space.

III. Temperatures and Set Points

A. All set points shall be fully adjustable and meet the following guidelines:

1. Occupied Heating: Set point 70° F, to maintain space temperatures no lower than 68° F
2. Occupied Cooling: Set point 76° F, to maintain space temperatures no higher than 78° F
3. Unoccupied Heating: Set point 55° F
4. Unoccupied Cooling: Set point 85° F

B. Cooling supply air temperature shall be maintained at design temperatures allotted on contract drawings and shall not exceed 62° F in administrative and instructional spaces with reheat capabilities.

IV. Schedules

A. Provide separate area scheduling capabilities for:

1. Administrative Offices
2. Media Center
3. Auxiliary
4. Gym (with locker rooms where applicable)
5. Cafeteria or Multi-Purpose Room
6. Auditorium
7. Classrooms: Zones shall be determined by PGCPS
8. Computer Lab
9. Daycare/Aftercare Room
10. Master Schedule for Building

V. Sequences

A. Located at the end of this section are several basic ATC sequences that should be used as the Basis of equipment sequences used by the design engineer on their project. These sequences are minimal and the design engineer will need to add the items that are unique to their project. Some items include valve types (2-way, 3-way, etc.), and auxiliary equipment interfacing with main equipment sequence (exhaust fans, sensors, dampers, etc.) that are specific to the project being designed.

B. The design engineer is to develop a point schedule for all appropriate equipment. The point schedules will then need to be reviewed and coordinated with PGCPS BAS

Department before drawings are submitted for final review. Points should be kept to a minimum and points that will be best utilized by PGCPS.

VI. Graphics

A. All proposed graphics shall be provided to PGCPS as submittals for review and approval prior to installation.

B. The home screen for each school shall include links to the Mechanical and Controls drawings, Balancing Reports, warranty certificate, Communications Layout and ATC as-builts.

VII. Direct Digital Building System Components

A. All components to be operable with a Tridium Niagara 4 framework with open protocol.

B. Wiring, conduits, and panels.

1. Wiring to serve device operating above 50 volts shall be equal to that specified in Division 26 for wires and cables. Wiring to serve devices operating below 50 volts is to be fully color coded, copper 600V type THW or THHN, minimum no. 22 or as specified in Division 26 electrical.
2. Conduit and fitting type and grade shall match that used by the Division 26 electric in various areas of the school. Types should match the following:
   a) Rigid, heavy-wall galvanized steel conduit conforming to UL6 and ANSI C80.0.
   b) Intermediate steel conduit (IMC) galvanized steel conduit conforming to UL 1242 and ANSI C80.03.
   c) Electrical metallic tubing (EMT) thin wall galvanized conforming to UL797 and ANSI C80.03.
   d) Surface metal raceway – equal to wire mold NO. 700 minimum size.
3. Control panels to be 16 gage galvanized steel cabinets with piano hinges and lockable latches. Provide only one panel per mechanical equipment room. Bolt panel to walls or building structure. Do not mount on equipment.

C. Control Dampers:

1. Supply air and return air control dampers shall be equal to Ruskin model CD35, multi-blade, 16 gage galvanized steel or aluminum blades, finished in black enamel frames, and have sound air-stops which prevent air leakage.
2. Outdoor air, exhaust air and pressure relief control dampers to be equal to Ruskin CD50 (min) or CD60 low Leakage dampers. Leakage to be no more than 4 CFM per square foot at 1-inch wg. when tested.

3. Two position control dampers can be parallel-blade type, modulating control dampers to be opposed-blade type.

D. Control Valves:
   1. Control valves to be sized based on a maximum pressure drop across water valve of 4.0 psi. Heating system valves are normally open to full flow in power loss and cooling system valves normally closed to stop flow to coil in the event there is power loss.
   2. Valves 2-inches and smaller to be single seated cast brass globe type valve capable of handling 280 degree F water at maximum of 150 Psig. Valves 2.5-inches and larger to be cast iron single seated valves capable of handling 250 degrees F water at maximum of 150 Psig. All butterfly valves used are to be high performance cast iron type with stainless steel or bronze disk capable of handling 225 degrees F water at maximum of 150 Psig.

E. Variable Frequency Drive (VFD):
   1. Acceptable manufacturers shall include:
      a) ABB
      b) Honeywell Smart VFD
   2. Variable frequency drives (VFD) are to be provided and installed by the control contractor for the project. VFD's are not to be supplied by the mechanical or electrical contractor unless the drive is used to operate the refrigeration part of the HVAC system, such as a chiller or compressor equipment. Drives normally supplied with package equipment may be supplied by control contractor. The control equipment supplier to be responsible for provide the correct VFD to accomplish the control sequence and fit physically in the space allotted.
   3. VFD's are not to be mounted in the air stream of air handling units or within 10 feet of a boiler. Each piece of equipment requiring a VFD is to be dedicated to that piece of equipment only. No motor sharing of VFD's. Provide a laminated list of fault codes attached to each VFD, inside door of the drive.
   4. VFD construction, accessories, and function shall meet the following requirements:
      a) VFD to be in a UL type 1 or 4x enclosure.
      b) VFD must have a minimum efficiency of 95 percent or better at half speed and 97 percent or better at rated full speed.
      c) VFD to be microprocessor based control with digital display and key pad operator station.

d) VFD to include a mechanical and electrical interlocked bypass.
e) VFD shall include real time clock (RTC) with automatic daylight savings time and calendar, able to provide three time channels.
f) VFD shall have built in 2 stand-alone PID control loops.
g) VFD shall include built-in dual 5 percent DC choke to minimize harmonic from the device.
h) Operational functionality required for each VFD.
(1) Motor switch ride-through
(2) Ramp time optimizer
(3) Over temperature ride-through
(4) Power ride-through
(5) Configurable automatic reset
(6) Flux optimization
(7) Flying start
(8) Automatic torque boost
(9) Resonance reduction using prohibited frequency ranges
(10) Motor pre-heat
(11) Sleep mode
(12) Temperature-controlled cooling fans

5. VFD manufacturer is to provide 16 hours of training and set-up time for the drives on the project. The control contractor is to have a representative from their firm present during this training and set-up period.
6. Drives are to be closed, free of debris dust before turnover

F. Instrumentation and Control Devices:
1. Room sensors to be accurate to plus or minus 1 degree, operating range of 35 to 115 degrees F., and set point adjustment range of 45 to 95 degrees F.
2. Humidity sensors to have a operating range of 10 to 90 percent relative humidity (RH) with a plus or minus 2 percent RH accuracy.
3. Carbon dioxide sensors to be equal to Vaisala gmd20 with a 0-2000 ppm range with a accuracy of plus or minus 30 ppm between 60 and 90 degrees F.
4. Differential pressure sensors to have a accuracy of plus or minus 0.5 percent of full scale and a operating temperature range of minus 40 to plus 200 degrees F.
5. Freeze stats to have a sensing element up to 20 feet that will properly cover the coil face and have adjustable set point.

6. Flow switches are to be paddle type equipped with SPDT contracts to establish proof of flow.
7. Actuators are to be powered with 24VAC or 24VDC with a proportional signal of 0-10VDC or 2-10VDC from the ATC Controller. Actuators will be full closed at 0/2VDC signal and display a value of 0% of the graphics. Actuators will be full open at 10VDC signal and display a value of 100% on the graphics. Floating Actuators will not be acceptable.

PART 3 – EXECUTION

I. GENERAL REQUIREMENTS
   A. Installation of ATC equipment or wiring cannot begin until submittals have been approved by design engineer and PGCPS.
   B. Control system and devices are to be installed in accordance with manufacturer's instructions, complete and operating as shown and specified.
   C. All ATC equipment and devices to be located in readily accessible locations. Locations to be approved by owner.
   D. A qualified, direct factory tech person shall operate, test, calibrate, and adjust each control system until it operates as specified in the control sequences.
   E. In the event an existing electronic control system is being replaced in an existing school project, the ATC contractor for the new system will be required to remove the existing school software from the energy management server at the Brown Station Road Facilities Complex.
   F. Cabling – No splices, no mixing of cable type, exception to splice - must be identified in location. No exceptions will be made for network communication wiring. This includes BACnet I/P, MS/TP, and I/P network wiring.

II. Sequences
   A. ATC contractor is to verify, based on the final approved manufacturers equipment, that the sequences on the contract drawings can remain as shown and do not need to be modified. In the event a modification to the sequences on the drawings is required, the change is to be discussed with design engineer and PGCPS Mechanical Systems Dept. before shop drawings are submitted.

III. Training
   A. The Controls Contractor shall provide the following training services:
      1. Two days of on-site training, 4 hours each day

a) One four (4) hour training course for the designated PGCPS personnel to be performed on job site.
b) One four (4) hour training course for the designated PGCPS personnel to be performed at the Brown Station Road Office. Time for this training will be adjusted to train PGCPS night time personnel.
c) The class shall be taught by a certified agent who is fully knowledgeable of the specific installation details of the project.
d) Agenda: The course agenda shall be provided by the contractor and shall include instruction on the specific systems and instructions for the operating the installed system. Topics covered should include as a minimum (however not limited to):
   (1) HVAC System Overview
   (2) Operation of Control System
   (3) Function of each Component
   (4) System Operating Procedures
   (5) Maintenance Procedures
   (6) Scheduling
   (7) Alarm Management
   (8) Trending

2. Off-Site Advanced Training:
   a) Two weeks of Advanced Training shall be provided at any time prior to the completion of the warranty period at the controls manufacturer's off-site training facility. **C**ontractor shall pay training registration, materials and miscellaneous fees. Contractor shall also pay for all expenses for travel (travel transportation, meals, lodging, etc.).
      (1) Advance training shall include the standard, advanced training offering on all control programming applications for the system installed.
      (2) Advance training shall include the standard, advanced training on installation, configuration, maintenance, network administrator and programming.

END OF SECTION

ATC SEQUENCES

GENERAL ITEMS (GI)

GI-1 General Notes for ATC System

GI-2 Auto-Occupied-Unoccupied Control

CENTRAL PLANT EQUPMENT (CPE)

CPE-1 Heating Water Plant Sequence

CPE-2 Chilled Water Plant Sequence-Air Cooled Chiller

CPE-3 Chilled Water Plant Sequence-Water Cooled Chiller

CPE-4 Chiller Room Ventilation and Refrigerant Control

TWO (2) PIPE SYSTEMS (TPS)

TPS-1 Fan Coil Unit-2 Pipe Chilled/Heating Water

TPS-2 Unit Ventilator-2 Pipe Chilled/Heating Water

TPS-3 Two Pipe System Isolation Valves

FOUR (4) PIPE SYSTEMS (FPS)

FPS-1 Fan Coil Unit-4 Pipe Heating Water and Chilled Water

FPS-2 Unit Ventilator-4 Pipe Heating Water and Chilled Water

AIR HANDLING UNITS (AHU)

AHU-1 Air Handling Unit – Single Zone VAV

AHU-2 Air Handling Unit – VAV with SF and RF

AHU-3 Rooftop Energy Recovery Unit-2 Pipe Chilled/Heating Water and DX Cooling

AHU-4 Energy Recovery Unit-4 Pipe Heating Water and Chilled Water

AHU-5 Kitchen Hood Exhaust System with make-up Air Unit+

GEOTHERMAL SYSTEM (GEO)

GEO-1 Geothermal Heat Pump Loop Pumping System-Basic

GEO-2 Geothermal Heat Pump Loop Pumping System with Closed Circuit Fluid Cooler Assistance

GEO-3 Heat Pump Unit Connected to Geothermal Heat Pump Loop Piping

EXHAUST FANS (EF)

EF-1 Exhaust Fan with Occupied/Unoccupied control

EF-2 Exhaust Fan with Room Sensor Control

EF-3 Exhaust Fan with Continuous Operation

EF-4 Exhaust Fan and Outside Air Damper with Room Temperature Sensor Control

EF-5 Kiln Exhaust Fan Control

MISCELLANEOUS ITEMS (MISC)

MISC-1 Single Duct VAV terminal with Heating Water Coil

MISC-2 Cabinet or Propeller Unit Heater

MISC-3 Finned Tube Radiation and Connector

MISC-4 Emergency Fan Disconnect Switch

MISC-5 Boiler Room Carbon Monoxide Sensor

MISC-6 Combustion Gas Detector System

MISC-7 High Temperature Refrigerator/Freezer Alarm

MISC-8 Domestic Hot Water Circulator

MISC-9 Freeze Protection Circulating Pump Control on Heating Coils

GI-1

General Notes for ATC System

1. Note to mechanical contractor that valve piping configurations for equipment are to be shown on control drawings so that the valves “fail safe” to the proper position. The mechanical contractor is advised to pipe the ATC valves as shown on the control drawings, which may not be the same as the mechanical contract drawings.
2. All EMS control and monitoring set points and schedules are to be adjustable through the system software.
3. Space temperature set points shall be as follows:
   a. Occupied – heating = 70 degrees F
   b. Occupied – cooling = 76 degrees F
   c. Unoccupied – heating = 55 degrees F
   d. Unoccupied – cooling = off (unless otherwise needed)
4. All low voltage ATC wiring to be run in plenum rated cable where concealed and accessible, and in rigid conduit in the boiler room. Any wiring in exposed areas other than boiler room should be installed in conduit of the same grade used by electrical contractor in that area.
5. Emergency fan disconnect switch control, smoke detectors, smoke dampers, and freeze detectors shall be hard wired and shall not require operation of DDC system software to operate or to de-energize system fans.
6. The control contractor shall be responsible for installing and wiring all control equipment supplied with the HVAC equipment and for providing power circuits for these and all other equipment in the entire control system. Control contractor shall also provide any ancillary components including but not limited to switches, relays, wiring, and conduit to accomplish intended control functions and/or control sequences that may be noted in the specifications.
7. Function of controls shall be restored to normal operation when safeties are reset or when power is restored after an outage. Freezestat tripping shall reset at the unit. Emergency fan disconnect tripping shall be reset when the disconnect switch is reset. Smoke detector tripping shall be reset when the alarm is no longer present in the fire alarm system.
8. Where smoke detector point is indicated, hard wiring of shut down is required. Additionally, a software input is required monitoring the smoke detector status so that a system user would be able to diagnose the cause of the shutdown.

9. Full Hvac Replacement Projects: For General systemic projects where all HVAC equipment is being replaced, even existing equipment that may not be replaced should have its ATC controls replaced. This includes items such as refrigerator/freezer alarms, combustible gas detecting, ATC lighting control, etc. Design engineer can acquire a list of all controls from PGCPS BAS department.
10. Partial Hvac Replacement Projects: For General systemic projects where only part of the HVAC equipment is being replaced, the extent of control system replacement should be reviewed with PGCPS Construction and HVAC department representatives. This includes partial HVAC equipment replacement jobs or additions to schools, etc.

GI-2

Auto – Occupied – Unoccupied Controls

A. **General**

a. The design engineer for the project is to provide an auto-occupied-unoccupied zone schedule for all the areas served in the building by HVAC equipment. Schedule to include zone numbers, area served, and equipment being controlled in each zone. Schedule to be on contract drawings and the ATC shop drawings.

B. **Operation**

a. Each zone as indicated on the schedule noted above shall have an auto-occupied-unoccupied time clock function.

b. When a zone is indexed to “auto” the equipment in that zone will function either on the “occupied” cycle or “unoccupied” cycle as determined by EMS.

c. When indexed to “occupied” the equipment in that zone will function on the “occupied” cycle. When indexed to “unoccupied” the equipment in that zone will function on the “unoccupied” cycle.

CPE-1

Heating Water Plant Sequence

(Boiler and Pumps Serving Heating Water Loop)

A. **Boiler Plant**

a. When the outside air temperature drops below 65° F (ADJ) the heating water plant shall be enabled. The lead heating water pump and lead boiler shall energize. The corresponding boiler circulator pump and all combustion air dampers shall be energized when boiler is enabled. Boiler shall modulate through internal controls to maintain the heating supply water temperature according to the reset schedule (developed by the design engineer).

b. When enabled, systems with two boilers shall be operated in a lead-lag configuration and alternate to maintain equal run time. Should the lead boiler fail to fire, the lag boiler shall be energized and an alarm shall be sent to the BAS.

B. **Heating Water Pumps**

a. The heating water pumps shall be controlled by the BAS. The heating water pumps shall be operated in a lead-lag configuration and alternate to maintain equal run time. When the heating water plant is enabled, the lead pump shall run continuously. The pumps shall modulate as needed based on the differential pressure sensor in the heating water loop. Upon failure of the lead pump as sensed by pump status, the lag pump shall be enabled and a lead pump failure alarm shall be generated. A flow switch shall be used to determine status/proof of pump.

C. **Safeties/Alarms**

a. The lead heating water pump shall be energized and proof of flow verified by the flow switch prior to a boiler firing. The combustion air dampers shall open and be proven open by the end switch prior to the boiler firing, based on local interlock. A CO monitor in the space shall provide an audible alarm and the boilers with their associated circulator and combustion air dampers shall be de-energized upon detection of CO and an alarm shall be sent to the BAS. If both hot water pumps fail OR the hot water loop temperature falls below 110 degrees (adj), an alarm shall be sent to the BAS and an email shall be sent to pre-determined personnel.

CPE-2

Chilled Water Plant Sequence- Air Cooled Chiller

(Air Cooled Chiller, Pumps, Heat Exchanger, Etc. Serving Chilled Water Loop)

A. **General**

a. The chilled water plant includes an air-cooled chiller, primary and secondary chilled water pumps, VFD's, glycol feeder, and glycol-to-water exchanger. The variable flow chiller plant shall be enabled by the BAS when outside air temperature is above the set point of 65°F (ADJ) and or as scheduled on contract drawings.

B. **Air-Cooled Chiller**

a. Upon the chiller plant being enabled, the lead primary chilled water pump, lead secondary chilled water pump, and chiller shall energize. The chiller shall modulate through internal controls to maintain the primary chilled water loop supply temperature set point indicated by design engineer. Should the primary chilled water loop temperature rise and remain continuously above for a 10 minute period (ADJ.) the chiller shall de-energize. The chiller plant shall be disabled when the outside air temperature is below 60°F (ADJ.)

C. **Primary Chilled Water Pumps**

a. The primary chilled water pumps shall be controlled by the BAS. This primary chilled water loop pumps water containing a glycol solution between air cooled chiller and plate heat exchanger. The primary chilled water pumps shall be operated in a lead-lag configuration and alternate to maintain equal run time. When the air cooled chiller is enabled, the lead pump shall run continuously. Upon failure of the lead pump as sensed by pump status, the lag pump shall be enabled and a lead pump failure alarm shall be generated. A flow switch shall be used to determine status of pump.

D. **Secondary Chilled Water Pumps**

a. The secondary chilled water pumps shall be controlled by the BAS. This secondary chilled water loop pumps water between the buildings cooling equipment and the plate heat exchanger. The chilled water pumps shall be operated in a lead-lag configuration and alternate to maintain equal run time. When the air cooled chiller is enabled, the lead pump shall run continuously. The pumps shall modulate as needed based on the differential pressure sensor in the building chilled water loop. Upon failure of the lead

pump as sensed by pump status, the lag pump shall be enabled and a lead pump alarm shall be generated. A flow switch shall be used to determine status of pump.

E. **Safeties**

a. The lead primary and secondary chilled water pumps shall be energized and proof of flow verified by the flow switches prior to air-cooled chiller being energized.

b. If both chilled water pumps fail OR condensing water pumps fail OR water temperature rises above 65 degrees (adj), an alarm shall be sent to the BAS and an email shall be sent to pre-determined personnel.

CPE-3

Chilled Water Plant Sequence – Water Cooled Chillers

A. **General**

a. Chiller, Primary and secondary chilled water pumps, condenser water pumps are to be controlled by the chilled water plant controller (provided by the chiller manufacturer)

b. Energizing the chilled water system shall be accomplished from a signal from the DDC computer provide an editable schedule for chiller plant operation and provide an adjustable temperature above which the chiller plant will operate when scheduled to be available.

c. Current sensing relays shall determine if the active primary, secondary, and condenser water pumps are operating properly. Pump failure will initiate an alarm at the DDC alarm printer.

d. Chiller plant controller shall include but not limited to:

i. Staging or sequencing of chiller and associated chilled and condenser water pumps based in part on part load performances and energy utilization.

ii. Monitor and control time utilization of each chiller.

iii. Switch operation of the lead chiller on a regularly scheduled basis.

iv. In case of a pump or chiller failure automatically switch operation to the other chiller.

B. **Chiller Plant Controller and Primary Chilled Water Pump**

a. The chiller manufacturer shall coordinate the control interface with the ATC contractor. The chiller manufacturer shall provide shop drawings showing point-to-point wiring diagrams of the interface between the DDC system and the chiller plant control system as well as between the components within the chiller plant control system. The chiller manufacture shall provide point-to-point diagrams and schematics with component inputs and outputs along with cut sheets and performance information of the input/output sensors and devices. The DDC control submittal shall include this information.

b. The ATC contractor shall be responsible for installing and wiring all control equipment supplied with the chiller and chiller plant controller including switches and relays or devices to accomplish the sequence of operation established by the design engineer. Provide control interface between chiller plant controller and the chiller control panel

and all associated components providing input to or receiving output from the chiller plant control system in accordance with the chiller manufacturer's wiring diagrams and recommendations. Provide all necessary wiring and devices to make the system operate according to the chiller control package requirements.

c. The chiller plant controller will receive a signal from the secondary chilled water pumps that they have been in operation for 5 minutes satisfactory. Then the chiller plant controller will start going through its control sequence. The controller will activate and assure the primary chilled water pump is operating satisfactory through its differential pressure control and check all system safeties before starting the chiller to produce chilled water.

C. **Secondary Chilled Water Pumps**

a. When the chilled water system is activated by PGCPS DDC computer, the secondary (building) chilled water pumps shall operate in sequence to maintain the differential pressure setpoint.

b. The lead pump shall be proven to be running via its current sensing relay for five minutes prior to the DDC system giving a signal to the chiller plant controller to energize the chiller plant and begin producing chilled water.

c. Lead pump's VFD shall modulate its pump motor speed to maintain the differential pressure setpoint.

d. Upon a loss of flow through the load pump for more than 10 seconds (adj.) as sensed by its current sensing relay, the lag pump shall be energized and controlled by sequence. An alarm message shall be sent to the DDC system.

e. Upon an invalid signal from a differential pressure sensor, the lead pump shall operate at maximum preset speed. Reset shall be automatic upon correction of failure.

f. Alternate lead and lag pump every 30 days.

g. When the chilled water system is de-activated, the secondary pumps shall be de-energized. When secondary pumps are off, operation of the chiller plant by the chiller plant controller shall be locked out.

h. Setpoints of differential pressure sensors shall be established during balancing.

D. **Condenser Water System**

a. The condenser water system shall be controlled by the chiller plant controller.

b. Condenser water supply temperature setpoint shall be determined by the chiller plant control system's energy management optimization program.

c. When a chiller's controls require condenser water operation, the tower inlet control valve shall open, if valve is required, and a condenser water pump shall be energized and run continuously.

d. Condenser water ATC cooling tower bypass valve shall modulate in opposition when required to ensure condenser water supply temperature does not fall below a minimum temperature setpoint, as sensed by associated insertion temperature sensor. Chiller manufacturer shall determine minimum temperature setpoint.

E. **Heat Tracing Control**

a. Provide electrical power to heat tracing when outside air temperature falls below 40 degrees F and disable electrical power when outside air temperature rises above 45 degrees F. Provide an alarm if current is not sensed in circuit when outside air temperature drops below 35 degrees F (adjustable).

CPE-4

Chiller Room Ventilation and Refrigerant Control

A. **General**
   a. Install refrigerant monitor and remote refrigerant sensors in accordance with manufacturer's' recommendations. Provide control interface with refrigerant monitor, exhaust fan and outside air damper through DDC panel.

B. **Ventilation Mode**
   a. When the set point of the room sensor is exceeded by 5 degrees F or when the timer switch is indexed to on, the outside air damper shall open and exhaust fan shall be energized.
   b. When the room sensor setpoint is satisfied or timer switch is indexed to off, the reverse shall occur. Provide a 5 degree F dead band on room sensor.

C. **Emergency Refrigerant Mode**
   a. When refrigerant is detected, as sensed by the refrigerant monitor, alarm locally and thru the DDC system to alert service personnel.
   b. Outside air damper shall open, exhaust fan, shall be energized, and chiller plant shall be de-energize. Operation shall be hard wired and shall not require operation of the DDC system in order to function.

TPS-1

Fan Coil Unit – 2 Pipe Chilled/Heating Water

A. **Occupied Cycle**
   a. The unit supply fan motor shall be energized and run continuously.
   b. With the system indexed in the heating mode; the control valve shall modulate water flow to the coil to maintain the heating setpoint of the room sensor.
   c. With the system indexed in the cooling mode, whenever the space temperature is more than 2 degrees F above the cooling setpoint of the room sensor, the control valve shall be positioned to provide full flow thru the coil. On a fall in space temperature to more than 2 degrees F below the cooling setpoint of the room sensor. The control valve shall be positioned to full bypass to the coil.

B. **Unoccupied Cycle**
   a. With the system indexed in the heating mode, unit supply fan motor and control valve shall be placed under control of the night setpoint of the room sensor, which shall cycle the fan motor and open the control valve to provide full flow across the coil to maintain temperature.

C. **Safety Control**
   a. Upon sensing excess water in secondary drain pan, condensate sensor shall de-energize fan coil unit and send alarm signal to PGCPS Mechanical Systems at Brown Station Facilities.

TPS-2

Unit Ventilator – 2 Pipe Chilled/Heating Water

A. **Occupied**

a. The supply fan motor will be energized and run continuously.

b. With the system indexed in the heating mode, the by-pass control dampers shall modulate air flow across coil to maintain the heating setpoint of the room sensor. Water flow through the coil to remain constant.

c. With the system indexed in the cooling mode, whenever the space temperature is more than 2 degrees above the cooling setpoint of the room sensor, the by-pass control dampers shall modulate air flow across coil to maintain the cooling setpoint. On a fall in space temperature to more than 2 degrees below the cooling setpoint of the room sensor, the bypass damper position for full air bypassing the coil.

d. With the unit ventilator in the economizer mode, with outdoor temperature below 62 degrees (adj.) the outside air damper will modulate open to maintain the space cooling temperature setpoint with the return air damper modulating accordingly.

e. Supply air low limit sensor will override the coil bypass damper to fully open, place outside air damper to minimum position with return air damper position accordingly, when the unit is in economizer to assure supply air temperature does not fall below 62 degrees (adj.)

f. When the economizer mode cannot satisfy the space room sensor setpoint of 76 degrees (adj.) and chilled water is available, the outside air damper to reposition to minimum setpoint and return air damper adjusting accordingly, and the bypass control dampers shall modulate air flow across coil to maintain the cooling setpoint.

g. If at any time the outside air temperature drops below 10 degrees (adj.), the outside air damper will be closed and the return air damper will open.

B. **Unoccupied**

a. The outside air damper will be closed and return air damper open. When the building system is indexed to the cooling mode the bypass damper shall be closed to the coil and the supply fan is to remain off until unit is placed in occupied mode. When the building system is indexed to the heating mode the room sensor will be indexed to the unoccupied heating temperature setpoint and the bypass damper shall be full open to coil. When the space temperature falls below the unoccupied setpoint, the unit supply

fan will cycle on. When the space temperature rises above the unoccupied heating setpoint, the unit supply fan will be disabled.

C. **Safety and Emergency Control**

a. Whenever the limitations of the freeze detector is exceeded, the supply fan will be de-energized. The outside air damper will close and return air damper will open. The coil bypass control damper is to be full open to coil. An alarm will be sent to the BAS. The low limit sensor will need to be manually reset before normal conditions are allowed to resume.

TPS-3

Two Pipe System Isolation Valves

A. **General**

a. Where heating only equipment is being served by the 2-pipe system loop, a set of isolation control valves are to be installed on the supply and return branch pipes serving the heating only unit. These control valves are not to be used for temperature control of the unit.

B. **Operation**

a. When the main heating-cooling change over switch is placed in the heating position the set of isolation control valves are to be open, and if the switch is placed in the cooling position the set of isolation control valves are to be closed.

FPS-1

Fan Coil Unit – 4 Pipe Heating Water and Chilled Water

A. **Occupied**
   a. The minimum outside air damper will be open and the supply fan motor will be energized and run continuously.
   b. The room sensor will modulate the heating control valve to maintain its space heating temperature setpoint.
   c. On a further rise in room temperature, after the heating control valve is fully closed to the coil, the cooling valve will open and close as needed to maintain the space cooling setpoint 76 degrees (adj.).
   d. A supply air low limit sensor will override the heating valve control when the outside air temperature is below 55 degrees to assure the supply air temperature does not fall below 62 degrees.
   e. If at any time the outside air temperature drops below 10 degrees (adj.), the outside air damper will be closed, and return air damper full open.

B. **Unoccupied**
   a. The outside air damper will be closed and the return air damper open. The heating valve will be open. The room sensor will be indexed to the unoccupied heating temperature setpoint. When the space temperature falls below the unoccupied setpoint, the unit supply air fan will cycle on. When the space temperature rises above the unoccupied heating setpoint, the fan coil unit will be disabled. The cooling mode on the unit will be disabled during the unoccupied, with the cooling control valve closed and the supply fan off.

C. **Safety and Emergency Control**
   a. Whenever the limitations of the freeze detector are exceeded, the supply fan motor will be de-energized. The outside air damper will close and return air damper will open. An alarm will be sent to The BAS. The low limit sensor will need to be manually reset before normal conditions are allowed to resume.

FPS-2

Unit Ventilator – 4 Pipe Heating Water and Chilled Water

A. **Occupied**
   a. The supply fan motor will be energized and run continuously.
   b. When first enabled, if the return temperature is below the warm-up setpoint of 68 degrees (adj.) the outside air damper will be closed and return air damper will be open. Heating control valve will be open for full flow to the coil. The cooling control valve is to remain in a closed position. When the return air rises above the warm-up temperature setpoint, outside air damper will open to its minimum position, with the return air damper position accordingly. Room sensor will modulate the heating control valve to maintain its space heating temperature setpoint.
   c. Economizer: on a further rise in-room temperature, after the control valve is fully closed to the coil, with outdoor temperature below 62 degrees (adj.), the outside air damper will modulate open to maintain the space cooling temperature setpoint with the return air damper modulating accordingly.
   d. Supply air low limit sensor will override the heating valve control when the unit is in economizer to assure supply air temperature does not fall below 62 degrees (adj.).
   e. If at any time the outside air temperature drops below 10 degrees (adj.), the outside air damper will be closed and the return air damper will open.
   f. When the economizer mode cannot satisfy the space room sensor setpoint of 76 degrees (adj.) and chilled water is available, the outside air damper to reposition to minimum setpoint and return air damper adjusting accordingly, and the cooling control valve shall open and close as required to maintain the space cooling setpoint of 76 degrees (adj.).

B. **Unoccupied**
   a. The outside air damper will be closed and return air damper open. The cooling valve will be closed and the heating valve will be open. The room sensor will be indexed to the unoccupied heating temperature setpoint. When the space temperature falls below the unoccupied setpoint, he unit supply fan will cycle on. When the space temperature rises above the unoccupied heating setpoint, the unit supply fan will be disabled.

C. **Safety and Emergency Control**

a. Whenever the limitations of the freeze detector is exceeded, the supply fan will be de-energized. The outside air damper will close and return air damper will open. Heating control valve to remain open. An alarm will be sent to the BAS. The low limit sensor will need to be manually reset before normal conditions are allowed to resume.

AHU-1

Air Handling Unit – Single Zone VAV with SF, Heating Water Coil and Chilled Water Coil

A. **General**

a. The single zone VAV air handling unit (AHU) with supply fan (SF) and any associated exhaust fans (EF) shall be started and stopped by a signal from the BAS as programmed (adj.). The AHU is equipped with a variable frequency drive on the SF, outside air damper, return air damper, and exhaust air damper. Supply air temperature is controlled by the modulating control valves for heating and cooling coils. The AHU shall receive an occupied/unoccupied status from the BAS as scheduled and shall apply to both the heating and cooling season.

B. **Optimized Start**

a. The AHU shall utilize an optimum start sequence prior to entering occupied mode. The unit shall use an algorithm accounting for the zone space temperature sensor and outside air temperature to calculate the minimum time required to change the space temperature to the occupied operation temperature. During optimized start operation, the outside air damper and exhaust air damper shall be closed. The return air damper shall be open. The SF shall be enabled. The unit shall modulate the control valve on the cooling coil or heating coil to supply air at the supply air temperature setpoint as determined by the BAS controller.

C. **Occupied**

a. During occupied mode, the AHU and EF's shall be energized. The AHU shall modulate the heating and cooling control valves to maintain zone temperatures of 70 degrees (adj.) in heating and 76 degrees (adj.) in cooling. Return air CO_2 shall be monitored and the outside air volume shall be modulated to maintain CO_2 at 1200 PPM (adj.). At no time shall less than the scheduled minimum operating outside air be provided. When the shared outside air temperature is below the switchover setpoint of 60 degrees (adj.) the dry bulb economizer shall be enabled.

D. **Unoccupied**

a. During unoccupied mode the SF and CF's shall be de-energized. The SF and EF's shall be programmed to maintain the unoccupied heating setpoint of 55 degrees (adj.) as sensed by the room temperature sensor. The outside air damper shall be closed. During unoccupied cooling mode the AHU and all associated coils, control valves, etc.

shall remain off. The outside air and exhaust air dampers shall be closed and return air damper open.

E. **SF Control**

a. The SF variable frequency drive shall maintain the minimum possible CO_2 level set by sensor. The return air and exhaust air dampers shall adjust, in proportion, with the outside air damper setpoint base on sensor setpoint.

F. **Safeties**

a. Upon a trip of the freeze state and/or the smoke detector, the SF and EF's shall stop, outside air and exhaust air dampers shall close. A local alarm and an alarm to the BAS. The freeze stat will require manual reset at site before unit can be energized.

AHU-2

Air Handling Unit – VAV with SF, RF, Heating Water Coil and Chilled Water Coil

A. **General**

a. The variable air volume (VAV) air handling unit (AHU) with supply fan (SF), return air (RF) and any associated exhaust fans (EF) shall be started and stopped by a signal from the BAS as programmed (adj.) the AHU is equipped with a variable frequency drive SF and RF, outside air damper, return air damper, and exhaust air damper. Supply air temperature is controlled by the modulating control valves for heating and cooling coils. The AHU shall receive an occupied/unoccupied status from the BAS as scheduled and shall apply to both the heating and cooling season.

B. **Optimized Start**

a. The AHU shall utilize an optimum start sequence prior to entering occupied mode. The unit shall use an algorithm accounting for the zone space temperature sensor and outside air temperature to calculate the minimum time required to change the space temperature to the occupied operation temperature. During optimized start operation, the outside air damper and exhaust air damper shall be closed. The return air damper shall be open. The SF and RF shall both be enabled. The unit shall modulate the control valve on the cooling coil or heating coil to supply air at the supply air temperature setpoint as determined by the BAS controller.

C. **Occupied**

a. During occupied mode, the SF, RF, and EF's shall be energized. The AHU shall modulate the heating and cooling control valves to maintain zone temperatures of 70 degrees (adj.) in heating and 76 degrees (adj.) in cooling. Return air CO_2 shall be monitored and the outside air volume shall be modulated to maintain CO_2 at 1200 PPM (adj.). At no time shall less than the scheduled minimum operating outside air be provided. When the shared outside air temperature is below the switchover setpoint of 60 degrees (adj.) the dry bulb economizer shall be enabled.

D. **Unoccupied**

a. During unoccupied mode the SF, RF, and EF's shall be energized. The SF, RF, and EF's shall be programmed to maintain the unoccupied heating setpoint of 55 degrees (adj.) as sensed by the associated VAV terminals. The outside air damper shall be closed. During unoccupied cooling mode the AHU and all associated coils, control

valves, etc. shall remain off. The outside air and exhaust air dampers shall be closed and return air damper open.

E. **SF and RF Control**

a. The SF variable frequency drive shall maintain the minimum possible to maintain a low limit supply air static pressure setpoint (adj.). A supply static pressure sensor shall slowly increase the SF speed to maintain supply static setpoint.

b. The associated RF shall modulate in conjunction with the SF utilizing the variable frequency drive on the RF. The RF shall lag the SF by a 10 percent differential (adj.).

F. **Safeties**

a. Upon a trip of the freeze stat and/or the smoke detector, the SF, RF, and EF's shall stop, outside air and exhaust air dampers shall close. A local alarm and an alarm to the BAS. The freeze stat will require manual reset at site before unit can be energized.

AHU-3

Rooftop Energy Recovery Unit – 2 Pipe Chilled/Heating Water and DX Cooling Coils

A. **General**
   a. The constant volume air handling unit (AHU), supply fan (SF), and exhaust fan (EF) shall be started and stopped by a signal from the BAS as programmed. The AHU is equipped with a constant speed SF and EF, outside air and exhaust air dampers, and fixed plate heat exchangers.

B. **Operation**
   a. Whenever the building system is indexed to heating, the control valve shall be open and modulating as require to maintain discharge temperatures. Whenever the building system is indexed to Cooling, the control valve shall be open and modulating as required to maintain discharge temperatures. Whenever Chilled water is unavailable and there is a call for cooling the DX shall be enabled to maintain discharge temperatures. The DX shall be locked out when outside air falls below 55 degrees (adj)

C. **Occupied**
   a. The AHU shall be energized by the occupied cycle programmed in the DDC clock and operate under its packaged controls.

D. **Unoccupied**
   a. When signal by the ATC system to energized the exhaust fan on the unit per owners direction. Otherwise the AHU, SF, and EF shall operate under its packaged controls.

E. **Safety and Emergency Controls**
   a. Whenever the limitations of the freezestat and/or smoke detector are exceeded, the SF and EF motors shall be de-energized, the outside air and exhaust air dampers shall close tight. The air cooled condensing unit shall be locked out during this cycle.

AHU-4

Energy Recovery Unit – 4 Pipe Heating Water and Chilled Water

A. **General**
   a. The constant volume air handling unit (AHU), supply fan (SF) and exhaust fan (EF) shall be started and stopped by a signal from the BAS as programmed. The AHU is equipped with a constant speed SF and EF, outside air and exhaust air dampers, and fixed plate heat exchanger. Supply air temperature is controlled by the modulating control valves on the heating and cooling coils. The AHU shall receive an occupied/unoccupied status from the BAS as scheduled and shall apply to both the heating and cooling season.

B. **Occupied**
   a. During occupied mode, the AHU, SF and EF shall be energized the AHU shall modulate the heating and cooling control valves to maintain a zone temperature of 70 degrees (adj.) in heating and 75 degrees (adj.) in cooling.

C. **Unoccupied**
   a. During unoccupied mode the AHU, SF, and EF shall normally be de-energized. The AHU, SF, and EF shall be called to run as needed to maintain the unoccupied heating setpoint of 55 degrees (adj.) The outside air and exhaust air dampers shall be normally closed.

D. **Safeties**
   a. Upon a trip of the freezestat and/or the smoke detector, the SF and EF shall stop, outside air and exhaust air dampers shall close. A local alarm and an alarm to the BAS. The freeze stat will require manual reset at site before unit can be energized.

AHU-5

Kitchen Hood Exhaust System with Make-Up

A. **General**
   a. Kitchen hood control panel shall be furnished by the kitchen exhaust hood manufacturer and complete with activation button, relays, local alarm, and controls to regulate the variable frequency drives provided by ATC contractor for supply fan (SF) and exhaust fan (EF). Control panel shall determine EF airflow, along with SF, and on/off output signals for the DDC monitoring control functions. Operation of the kitchen hood exhaust system shall be independent of occupied/unoccupied time scheduling.
   b. The ATC contractor shall be responsible for installing and wiring all control equipment supplied with kitchen hood exhaust system, providing interface and wiring between kitchen hood control panel and DDC control panel, and providing interface and wiring between variable frequency drives, supplied by contractor, for EF and make-up air unit fan motors.

B. **Operation**
   a. Whenever the system is energized through the kitchen hood control panel, EF and make-up air fan motors shall be energized through their corresponding variable frequency drives.
   b. Operating EF and make-up air unit fan motor speeds shall be controlled through kitchen hood control panel sequence. Make-up air unit motor speed shall track EF motor speed such that both fans are operating at an equal percentage of their respective design airflow value.
   c. When energized, make-up air unit shall operate under its packaged sequence for temperature control to maintain a discharge supply air setpoint of 70 degrees (adj.).
   d. Whenever the system is de-energized through the kitchen hood control panel, EF and make-up air unit supply fan motors shall be de-energized.

C. **Safety and Emergency Controls**
   a. Whenever the emergency fan disconnect switch is thrown or the limitations are exceeded by the current sensing relay, the EF and make-up air unit shall be de-energized.
   b. If a kitchen hood exhaust system continuously operates for a 24 hour (adj.) time period, provide an alarm through the DDC panel indicating such.

c. Whenever the limitations are exceeded by any duct smoke detector while the system is energized, the make-up air unit shall be de-energized and the EF shall remain energized.

GEO-1

Geothermal Heat Pump Loop Pumping System – Basic

A. **Operation**

a. Lead geothermal pump shall be energized and run continuously.

b. Upon loss of flow through the lead pump for more than ten seconds, the lag pump shall be energized and remote alarm shall sound.

c. Pumps and variable frequency drives (VFD) shall be placed under control of DDC panel pump control program for variable flow operation.

d. Pressure sensor shall send a signal through pressure transducer to the pump DDC controller program, indicating pressure differential conditions. The program shall compare each signal to preset setpoint.

e. When all pressure differential setpoint are satisfied, the pump speed shall remain constant.

f. As any sensor deviates from setpoint, the program shall send the appropriate signal to the pump VFD to increase or decrease the pump motor speed.

g. The program shall continuously scan and compare each pressure differential variable to its individual setpoint and control of the least satisfied sensor.

h. In the event of a system differential pressure failure due to a pump or VFD fault, the program shall automatically start the lag pump and continue variable speed operation.

i. In the event of failure to receive pressure variable signals, the pump shall maintain 100 percent speed required to satisfy schedule pump performance and the heat pump two-way control valves shall open. Reset shall be automatic upon correction of the failure.

j. System fault shall be continuously displaced until the fault has been corrected.

GEO-2

Geothermal Heat Pump Loop Pumping System – with Closed Circuit Fluid Cooler Assistance

A. **General**
   a. Generally the geothermal heat pump borehole field sizing is based on the building's normally larger cooling system heat rejection demand compared to the heating absorption demand from the borehole field.
   b. Due to lack of land to install a geothermal borehole field to satisfy the entire cooling system demand and/or to reduce construction cost, a closed circuit fluid cooler can be installed in the loop system to handle the differential in system demand between cooling season and heating season or more, if design demands.

B. **Operation**
   a. The geothermal pumping system would remain the same as specified under "Geothermal Heat Pump Loop Pumping System-Basic" control sequence. Additional program items are as follows:
      i. Cooling Mode
         1. DDC system shall place geothermal loop system in cooling mode when outside air temperature is above 65 degrees (adj.).
         2. The ATC diverting control valve shall be positioned to flow calculated GPM through closed circuit fluid cooler and remainder to geothermal borehole field.
         3. Water treatment system shall be energized.
         4. Whenever cooler entering water temperature is below 80 degrees the fan motor and spray pump shall be de-energized.
         5. Whenever cooler entering water temperature is between 80 to 90 degrees, the fan motor shall be de-energized and the spray pump shall be energized.
         6. Whenever cooler entering water temperature is above 90 degrees, the fan motor and spray pump shall be energized.
      ii. Heating Mode
         1. DDC system shall place system in heating mode when outside air temperature is below 60 degrees setpoint.
         2. The ATC diverting control valve shall be closed to the closed circuit fluid cooler and generally all flow to the geothermal borehole field. A small heating

bypass control valve shall be installed to allow for a small flow through the closed circuit fluid cooler to protect the cooler from freezing.

iii. Safety Controls

1. A vibration switch shall de-energize the closed circuit fluid cooler fan and spray pump upon a high vibration level. All devices shall return to fail positions.

GEO-3

Heat Pump Unit Connected to Geothermal Heat Pump Loop Piping

A. **Occupied**
   a. The unit supply fan motor shall be energized and run continuously.
   b. On a fall in space temperature the room sensor shall place heat pump unit reversing valve in the heating position and open the two-way unit isolation control.
   c. Valve on the heat pump return pipe. After the control valve is proven open the compressor shall energize and maintain room sensor heating setpoint. When compressor is de-energized the control valve shall close.
   d. On a rise in space temperature the room sensor shall place heat pump unit reversing valve in the heating position and open the two-way unit isolation control valve on the heat pump return pipe. After the control valve is proven open the compressor shall energize and maintain room sensor cooling setpoint. When compressor is de-energized the control valve shall close.

B. **Unoccupied**
   a. The heat pump unit supply fan shall be placed under control of the night setpoint of the room sensor which shall cycle the supply fan, two-way isolation control valve and unit compressor to maintain the sensor unoccupied heating setpoint.
   b. Heat pump unit shall be de-energized and control valve shall be closed when system is indexed to the unoccupied cooling mode.

EF-1

Exhaust Fan with Occupied/Unoccupied Control

A. **Operation - Occupied**
   a. Whenever the system is in occupied mode, and outside air damper on air handling unit is open, exhaust fan(s) shall run continuously.

B. **Operation - Unoccupied**
   a. Whenever the system is in unoccupied mode, and outside air damper on air handling unit is closed, exhaust fan(s) shall be de-energized.

EF-2

Exhaust Fan with Room Sensor Control

A. **Operation**

a. On a rise in temperature above the room sensor set point, the exhaust fan shall be energized. On a fall in temperature below the room sensor set point, the exhaust fan shall be de-energized.

EF-3

Exhaust Fan with Continuous Operation

(Fans for Science Chemical Storage, Storage of possible Hazardous Material, Etc.)

A. **Operation**

a. Exhaust fan shall be energized through the DDC system and operate continuously. A current sensing relay on the exhaust fan motor shall send an alarm signal to central control center if motor fails and stops.

EF-4

Exhaust Fan and Outside Air Damper with Room Temperature Sensor Control

A. **Operation**

a. On a rise in temperature of 5 degrees F above room temperature sensor set point (80 degrees F) the fan shall be energized and run continuously and damper shall open.

b. When room temperature sensor is satisfied the fan shall be de-energized and damper shall close.

EF-5

Kiln Exhaust Fan Control

A. **General**

a. Kiln exhaust system can be supplied with the kiln, but based on kiln room location, package controls supplied may not work. This sequence would be used when control is supplied by ATC.

B. **Operation**

a. Whenever kiln is manually energized through local switch (by electrical) exhaust fan shall be energized.

b. Whenever kiln is de-energized exhaust fan shall continue to run through delay shutdown (by ATC system) for adjustable time period. Initial time period shall be set to delay for 8 hours. Exhaust fan shall be de-energized at the end of delay period.

MISC-1

Single Duct VAV Terminal with Heating Water Coil

A. **General**

a. The VAV terminal shall be equipped with a heating coil, reheat valve for each VAV terminal heating coil and discharge air sensor for monitoring purposes. If some space temperature sensor need to be equipped with an occupied override button, indicate room location on plans.

B. **Occupied Mode**

a. When the temperature is between the occupied heating and cooling set points 70-76 degrees F (ADJ.), the primary air damper shall be at minimum CFM position with the reheat valve in the bypass position. On a rise in temperature above the cooling set point, the primary air damper shall increase the supply CFM. On a drop in the space temperature below the heating set point, the primary air damper shall maintain minimum CFM and the reheat valve shall modulate heating water to the heating coil as needed to maintain the space temperature set point.

C. **Unoccupied Mode**

a. During unoccupied mode the primary air damper will normally be at the minimum CFM position with the reheat valve closed and unoccupied heating and cooling set points 55-85 degrees F (ADJ.) shall be in effect. Upon a call for heating or cooling, the associated air handling unit shall be called to run and the terminal shall operate as in occupied mode, except with unoccupied set points, until space is again at set point. The occupied override button shall put the VAV terminal and associated air handling unit into occupied mode for up to 3 hours, in one hour increments.

MISC-2

Cabinet or Propeller Unit Heaters

A. **Operation**

a. On a fall in temperature below the room sensor set point (70 degrees F) the control valve shall open. On a rise in temperature 5 degrees F above the room sensor set point, the control valve shall close.

b. On a rise in pipe temperature, as sensed by the surface mounted pipe sensor on the return pipe (100 degrees F) and when the valve is open, the unit heater fan motor shall be energized.

c. On a fall in pipe temperature, below the set point of the surface mounted pipe sensor or when the valve is closed, the unit heater fan motor shall be de-energized.

MISC-3

Finned Tube Radiation and Convector

A. **General**

a. The temperature sensor for the finned tube radiation is to be unit mounted. The temperature sensor for the convector can be unit mounted or wall mounted, based on where the convector is located and if the sensor is subject to abuse.

B. **Operation**

a. On a fall in temperature below the sensor setpoint, the control valve shall modulate open.

b. On a rise in temperature above the sensor setpoint, the control valve shall close.

MISC-4

Emergency Fan Disconnect Switch

A. **Operation**

a. Provide a manual push button switch with local alarm cover near the main entrance to the school. Exact location to be coordinated with local Fire Marshal. This emergency push button switch will shut down all air handling equipment that is handling 2000 CFM or more. This switch is only to be used by the Fire Department in case of an emergency as determined by their personnel.

MISC-5

Boiler Room Carbon Monoxide Sensor System

A. **Operation**

a. If carbon monoxide is detected by sensors in boiler room, an alarm signal shall be energized at the DDC system and a local alarm shall sound.

MISC-6

Combustion Gas Detector System

A. **General**

a. If gas (natural or bottled LP gas) is used as the main fuel on heating equipment, such as boilers, water heaters, etc., in the boiler/mechanical room, this control sequence is to be supplied.

B. **Operation**

a. If gas is detected by sensors in boiler/mechanical room, the gas monitor panel shall send and alarm signal to the DDC system and sound a local alarm in the room and in the hallway outside of the boiler/mechanical room. Activation of this alarm will override all other signals and notify the DDC operator immediately of this emergency.

MISC-7

High Temperature Refrigerator/Freezer Alarm

A. **General**

a. This control sequence shall be used when there is a walk-in type refrigerator and/or freezer on the project.

B. **Operation**

a. Whenever the set point of the high temperature sensor in the walk-in refrigerator or the freezer is exceeded, the alarm reporting device of the DDC system shall be activated. Set points shall be determined in cooperation with school personnel. Local alarm shall also sound in the room where the refrigerator and/or freezer is located.

b. Latching alarm is to be supplied which requires manual reset at the freezer or refrigerator via a push button.

c. Alarm reporting device shall notify school personnel of condition.

MISC-8

Domestic Hot Water Circulator

A. **Operation – Occupied**
   a. On a fall in water temperature below the immersion sensor “on” setpoint, the circulator shall be energized.
   b. On a rise in water temperature above the immersion sensor “off” setpoint the circulator shall be de-energized.

B. **Operation-Unoccupied**
   a. The circulator shall be de-energized.

MISC-9

Freeze Protection Circulating Pump Control on Heating Coils

A. **Operation**

a. Whenever the outside air temperature is below 50 degrees (adj.) and heating water is available as indicated by DDC system, the heating coil circulator shall be energized. Whenever the outside air temperature is above 55 degrees (adj.) the circulator shall be de-energized. Upon loss of flow for more than 10 seconds (when control requires pump operation) as sensed by flow sensor, an alarm shall be energized through the DDC panel.

Part 1 - General

I. Summary
   A. This Section includes fuel oil and diesel fuel piping, specialties, and accessories within the building.

II. Performance Requirements
   A. Minimum Working-Pressure Rating: Unless otherwise indicated, minimum pressure requirement for fuel oil piping is 150 psig.

III. Submittals
   A. Product Data: For the following:
      1. Specialty valves.
      2. Fuel oil transfer pumps. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.
   B. Shop Drawings: Fuel oil piping and equipment. Include plans and attachments to other Work.
      1. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
   C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
   D. Maintenance Data: For fuel oil transfer pumps to include in maintenance manuals specified in Division 1.

IV. Quality Assurance
   A. Product Options: Drawings indicate size, profiles, and dimensional requirements of oil transfer pumps and are based on the specific model indicated. Other manufacturers' products complying with requirements may be considered. Refer to Division 1 Section "Substitutions."
   B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
   C. Comply with ASME B31.9, "Building Services Piping," for fuel oil piping materials, installation, inspection, and testing.
   D. Comply with NFPA 30, "Flammable and Combustible Liquids Code," and NFPA 31, "Installation of Oil Burning Equipment," for fuel oil piping materials, components, installations, inspection, and testing.

E. Comply with NFPA 70 "National Electrical Code" for electrical connections between wiring and electrically operated control devices.

F. Provide listing/approval stamp, label, or other marking on equipment made to specified standards.

G. Listing and Labeling: Provide equipment and accessories that are listed and labeled.

1. Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

Part 2 - Products

I. Manufacturers

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Oil Shutoff Valves:
   a) Conbraco Industries, Inc.; Apollo Div.
   b) Jomar International, Ltd.
   c) Kitz Corp. of America.
   d) McCanna, Inc.
   e) Nibco, Inc.
   f) Watts Industries, Inc.; Water Products Div.
2. Pressure-Reducing Valves:
   a) Anderson, Greenwood & Co.; Kunkle Valve Div.
   b) Fulflo Specialties Co.
   c) IMI Cash Valve, Inc.
   d) Webster Heating.
3. Oil Safety Valves:
   a) Suntec Industries, Inc.
   b) Webster Heating.
4. Fuel Oil Transfer Pumps:
   a) Baker Manufacturing Co.; Haight Pump Div.
   b) Desmi, Inc.
   c) Suntec Industries, Inc.
   d) Tuthill Corp.; Tuthill Pump Div.

e) Viking Pump, Inc.

f) Webster Heating.

5. UL-Listed, Fuel Oil Transfer Pumps:

a) Tuthill Corp.; Tuthill Pump Div.

b) Viking Pump, Inc.

c) Webster Heating.

6. Duplex, Fuel Oil Transfer Pump Sets:

a) Alyan Pump Co.

b) APT, Inc.

c) Hydronic Modules Corp.

d) Preferred Utilities Manufacturing Corp.

e) Smith-Koch, Inc.

f) Webster Heating.

II. Piping Materials

A. Steel Pipe: ASTM A 53, Type E or S, Grade B, Schedule 40, black.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern, with threaded ends according to ASME B1.20.1.
2. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends according to ASME B1.20.1.
3. Steel Welding Fittings: ASME B16.9, wrought steel or ASME B16.11, forged steel.
4. Steel Threaded Fittings: ASME B16.11, forged steel with threaded ends according to ASME B1.20.1.

B. Transition Fittings: Type, material, and end connections to match piping being joined.

C. Pipe Connectors: UL 567, swivel or compression type for connection to equipment.

D. Common Joining Materials: Refer to Division 15 Section "Basic Mechanical Materials and Methods" for joining materials not in this Section.

III. Specialty Valves

A. Oil Shutoff Valves: UL 842; metal-body ball valve with threaded ends according to ASME B1.20.1 for pipe threads.

B. Pressure-Reducing Valves: UL listed for fuel oil service. Include bronze body with 150-psig minimum pressure rating.

C. Oil Safety Valves: UL listed for fuel oil service. Include metal body; broken-line, oil shutoff feature; and 40-psig minimum pressure rating.

IV. Fuel Oil Transfer Pumps

A. Fuel Oil Transfer Pump: Comply with UL 343 and HI 3.1-3.5, single- or two-stage, internal-gear, positive-displacement, rotary type. Include steel base; foot-mounted, cast-iron housing; steel gears; bronze bearings; steel shaft; mechanical seals; and built-in pressure relief bypass.
   1. Drive: direct close coupled.
   2. Motor: Comply with Division 15 Section 15055 "Motors."

B. Fuel Oil Transfer Pump Sets: Factory-fabricated and -wired, packaged unit; for fuel oil service, listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction; with base, strainer, two fuel oil pumps, and controls.
   1. Base: Steel with pumps, accessories, and controls factory mounted.
   2. Pumps: Comply with HI 3.1-3.5, single- or two-stage, internal-gear with crescent, positive-displacement, rotary type. Include foot-mounted, cast-iron housing; steel gears; bronze bearings; steel shaft; mechanical seals; and built-in pressure relief bypass.
   3. Drives: direct close coupled.
   4. Motors: Comply with Division 15 Section "Motors."
   5. Piping: Steel with ferrous fittings and threaded or welded joints.
   6. Strainer: Duplex, basket type with corrosion-resistant-metal-screen baskets.
   7. Controls: Automatic operation with pump alternator and broken-line, oil shutoff feature.

Part 3 - Execution

I. Service Entrance Piping
   A. Extend fuel oil piping and connect to fuel oil distribution for service entrance into building.

II. Piping Applications
   A. General: Flanges, unions, transition, and special fittings with pressure ratings same as or higher than system pressure rating may be used in applications below, unless otherwise indicated.
   B. Piping: Steel pipe, malleable-iron fittings, and threaded joints.

III. Valve Applications
   A. Shutoff Valves:
      1. Install ball valves at each branch connection to supply mains and elsewhere as indicated for piping 2 inches and smaller.
      2. Use gate valves for piping 2-1/2 inches and larger.

B. Gate and Check Valves, 2” NPS and Smaller: Use general-duty valves that comply with MSS SP-80, Class 125, bronze body, suitable for fuel oil service, with "WOG" indicated on body. Refer to Division 15 Section "Valves" for selection. Install swing check valves as required to control flow direction.
   1. Gate Valves: With solid wedge.
   2. Swing Check Valves: With bronze disc.
   3. Lift Check Valves: Vertical pattern; two-piece construction with bronze disc.

C. Drain Valves: Use hose-end drain valves that comply with MSS SP-110, bronze ball valve with outlet connection according to ASME B1.20.7 for garden-hose thread with cap. Install drain valves at low points in mains, risers, branch lines, and elsewhere as required for system drainage. Refer to Division 15 Section "Plumbing Specialties" for selection.

IV. Piping Installation

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation requirements.

B. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

C. Install strainers on the supply side of each control valve, pressure regulating valve, oil burner connection, and elsewhere as indicated. Install 3/4inch pipe nipple and ball valve in blowdown connection of strainers 2-1/2 inches and larger. Use same size nipple and valve as blowdown connection of strainer on strainers 2 inches and smaller.

D. Install sediment traps at points where sediment or condensate may collect. Locate where readily accessible to permit cleaning and emptying. Do not install where condensate would be subject to freezing.
   1. Construct sediment traps using tee fitting with bottom outlet plugged or capped. Use minimum-length nipple of 3 pipe diameters, but not less than 3 inches long, and same size as connected pipe. Install with space between bottom of drip and floor for removal of plug or cap.

E. Install pressure gages on suction and discharge piping of each fuel oil pump set.

V. Joint Construction

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

VI. Valve Installation

A. Install valves in accessible locations, protected from possible damage.

B. Install valves at branch connections to supply mains and at equipment.

C. Install drain valves at piping low points.

D. Refer to Division 15 Section 15110 "Valves" for general installation requirements.

VII. Hanger And Support Installation

A. Refer to Division 15 Section "Hangers and Supports" for pipe hanger and support devices.

B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. 1/2” NPS and Smaller: Maximum span, 60 inches; minimum rod size, 3/8 inch.
2. 3/4" NPS to 1-1/4” NPS: Maximum span, 84 inches; minimum rod size, 3/8 inch.
3. 1-1/2” NPS: Maximum span, 108 inches; minimum rod size, 3/8 inch.
4. 2” NPS: Maximum span, 10 feet; minimum rod size, 3/8 inch.

C. Support vertical steel pipe at each floor and at spacing not greater than 15 feet.

D. Install hangers for horizontal drawn-temper copper tubing with the following maximum spacing and minimum rod sizes:

1. 1/2” and Smaller: Maximum span, 48 inches; minimum rod size, 3/8 inch.
2. 3/4” : Maximum span, 60 inches; minimum rod size, 3/8 inch.
3. 1” and 1-1/4” : Maximum span, 72 inches; minimum rod size, 3/8 inch.
4. 1-1/2” and 2” : Maximum span, 96 inches; minimum rod size, 3/8 inch.

E. Support vertical copper tube at each floor and at spacing not greater than 10 feet.

VIII. Connections

A. Install piping adjacent to equipment to allow service and maintenance.

B. Connect piping to equipment with oil shutoff valve and union. Install union between valve and equipment.

C. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

D. Electrical Connections: Wiring is specified in Division 16 Sections.

IX. Field Quality Control

A. Inspect and test fuel oil piping according to NFPA 30, "Testing" Paragraph and NFPA 31, "Tests of Piping" Paragraph; and according to requirements of authorities having jurisdiction.

B. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Report test results promptly and in writing to Engineer.

X. Demonstration

A. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining fuel oil pump sets.

B. Review data in maintenance manuals. Refer to Division 1 Section "Contract Closeout."

C. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."

D. Schedule training with Owner, through Engineer, with at least seven days' advance notice.

XI. Commissioning

A. Before activating system perform these steps:

1. Open valves to full open position and close bypass valves.
2. Remove and clean strainer screens.
3. Check pump for proper direction of rotation.
4. Fill oil storage tank with proper fuel type.
5. Check operating controls of fuel burner units.
6. Check operation at automatic bypass valves.
7. Check and set operating temperature controls on oil heaters.
8. Check corrosion monitoring systems for proper operation.

END OF SECTION

Part 1 - General

I. Related Documents
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

II. Summary
   A. This Section includes fuel gas piping, specialties, and accessories within the building.
   B. Related Sections include the following:
      1. Division 23 Section "Meters and Gages" for pressure gages.

III. Project Conditions
   A. Gas System Pressure: As shown on the drawings.
   B. Design values of fuel gas supplied for these systems unless shown differently on the drawings, are as follows:
      1. Nominal Heating Value: 1000 Btu/cu. ft.
      2. Nominal Specific Gravity: 0.6.

IV. Submittals
   A. Product Data: For the following:
      1. Corrugated, stainless-steel tubing systems. Include associated components.
      2. Specialty valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
      3. Service-meter bars. Include service-meter size of selected models.
      4. Service meters. Include pressure rating and capacity of selected models.
      5. Service-meter bypass fittings.
      6. Pressure regulators. Include pressure rating, capacity, and settings of selected models.
   B. Shop Drawings: For fuel gas piping. Include plans and attachments to other Work. Show different pressure zones and indicate pressure for each zone.
      1. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
   C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
   D. Maintenance Data: For natural gas specialties and accessories to include in maintenance manuals specified in Division 1.

V. Quality Assurance

A. Electrical Components and Devices: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. ANSI Standard: Comply with ANSI Z223.1, "National Fuel Gas Code."

C. FM Standard: Provide components listed in FM's "Fire Protection Approval Guide" if specified to be FM approved.

D. IAS Standard: Provide components listed in IAS's "Directory of A. G. A. and C. G. A Certified Appliances and Accessories" if specified to be IAS listed.

E. UL Standard: Provide components listed in UL's "Gas and Oil Equipment Directory" if specified to be UL listed.

VI. Delivery, Storage, And Handling

A. Handling Flammable Liquids: Remove and legally dispose of liquids from drips in existing gas piping. Handle cautiously to avoid spillage and ignition. Notify fuel gas supplier. Handle flammable liquids used by Installer with proper precautions and do not leave on premises from end of one day to beginning of next day.

VII. Coordination

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Engineer not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Engineer's written permission.

Part 2 - Products

I. Manufacturers

A. Manufacturers: Subject to compliance with requirements, provide products by one of the listed approved manufacturers. War-flex piping systems are not acceptable. Approved manufacturers include:

1. Corrugated, Stainless-Steel Tubing Systems:
   a) Omega Flex, Inc.
   b) Titeflex Corp.
   c) Tru-Flex Metal Hose Corp.
   d) Ward Manufacturing, Inc.
   e) Approved Equal.

2. Appliance Connector Valves:
    a) American Valve.
    b) B&K Industries, Inc.
    c) Brass Craft Manufacturing Co.
    d) Cimberio Valves, S. p. A.
    e) Conbraco Industries, Inc.; Apollo Div.
    f) E. M. Plastic and Electric Products, Ltd.; Neo Valve Div.
    g) Frey: John M. Frey Co.
    h) Jomar International, Ltd.
    i) Key Gas Components, Inc.
    j) Legend Valve and Fitting, Inc.
    k) McDonald: A. Y. McDonald Mfg. Co.
    l) Mueller Co.; Mueller Gas Products Div.
    m) Newman Hattersley, Ltd.; Specialty Valve Div.
    n) Robert Manufacturing Co.
    o) State Metals, Inc.
    p) Watts Industries, Inc.; Water Products Div.
    q) Approved Equal.
3. Gas Valves, 2" NPS and Smaller:
    a) BMI Canada, Inc.
    b) Crane Valves.
    c) Dungs: Karl Dungs, Inc.
    d) Flow Control Equipment, Inc.
    e) Grinnell Corp.
    f) Honeywell, Inc.
    g) Jomar International, Ltd.
    h) Kitz Corp. of America.
    i) Legend Valve and Fitting, Inc.
    j) Lyall: R. W. Lyall & Co., Inc.
    k) McDonald: A. Y. McDonald Mfg. Co.
    l) Milwaukee Valve Co., Inc.
    m) Mueller Co.; Mueller Gas Products Div.
    n) Nibco, Inc.
    o) Red-White Valve Corp.

p) Velan Valve Corp.

q) Watts Industries, Inc.; Water Products Div.

r) Approved Equal.

4. Plug Valves, 2-1/2" NPS and Larger:

a) Flow Control Equipment, Inc.

b) Milliken Valve Co., Inc.

c) Nordstrom Valves, Inc.

d) Olson Technologies, Inc.; Homestead Valve Div.

e) Walworth Co.

f) Approved Equal.

5. Automatic Gas Valves:

a) ASCO General Controls.

b) ASCOLECTRIC, Ltd.

c) Automatic Switch Co.

d) Dungs: Karl Dungs, Inc.

e) Eaton Corp.; Controls Div.

f) Eclipse Combustion, Inc.

g) GPS Gas Protection Systems, Inc.

h) Honeywell, Inc.

i) Johnson Controls, Inc.

j) Approved Equal.

6. Electrically Operated Gas Valves:

a) ASCO General Controls.

b) Atkomatic Valve Co., Inc.

c) Automatic Switch Co.

d) Dungs: Karl Dungs, Inc.

e) Eclipse Combustion Inc.

f) Goyen Valve Corp.

g) Magnatrol Valve Corp.

h) Parker Hannifin Corp.; Climate & Industrial Controls Group; Skinner Valve Div.

i) Approved Equal.

7. Line Pressure Regulators:

a) American Meter Co.

b) Donkin: Bryan Donkin RMG Canada, Ltd.

c) Eclipse Combustion, Inc.
d) Equimeter, Inc.
e) Fisher Controls International, Inc.
f) Maxitrol Co.
g) National Meter.
h) Richards Industries, Inc.; Jordan Valve Div.
i) Schlumberger Industries; Gas Div.
j) Approved Equal.

8. Appliance Pressure Regulators:

a) Canadian Meter Co., Inc.
b) Eaton Corp.; Controls Div.
c) Harper Wyman Co.
d) Maxitrol Co.
e) SCP, Inc.
f) Approved Equal.

II. Piping Materials

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

III. Corrugated, Stainless-steel Tubing Systems

A. Description: Comply with AGA LC 1 and include the following:
1. Tubing: Corrugated stainless steel with plastic jacket or coating.
2. Fittings: Copper alloy with ends made to fit corrugated tubing. Include ends with threads according to ASME B1.20.1 if connection to threaded pipe or fittings is required.
3. Striker Plates: Steel, designed to protect tubing from penetrations.
4. Manifolds: Malleable iron or steel with protective coating. Include threaded connections according to ASME B1.20.1 for pipe inlet and corrugated tubing outlets.

IV. Pipes, Tubes, Fittings, And Joining Materials

A. Steel Pipe: ASTM A 53; Type E or S; Grade B; Schedule 40; black.
1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern, with threaded ends according to ASME B1.20.1.
2. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends according to ASME B1.20.1.
3. Cast-Iron Flanges and Flanged Fittings: ASME B16.1, Class 125.

4. Steel Welding Fittings: ASME B16.9, wrought steel or ASME B16.11, forged steel.
5. Steel Threaded Fittings: ASME B16.11, forged steel with threaded ends according to ASME B1.20.1.
6. Joint Compound and Tape: Suitable for natural gas.
7. Steel Flanges and Flanged Fittings: ASME B16.5.
8. Gasket Material: Thickness, material, and type suitable for natural gas.

B. Hard Copper Tube: ASTM B 88, Type L, water tube, drawn temper.
1. Copper Fittings: ASME B16.22, wrought copper, streamlined pattern.
2. Brazing Filler Metals: AWS A5.8, Silver Classification BAg-1. Filler metal containing phosphorus is prohibited.
3. Bronze Flanges and Flanged Fittings: ASME B16.24, Class 150.
4. Gasket Material: Thickness, material, and type suitable for natural gas.

C. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.
1. Copper Fittings: ASME B16.22, wrought copper, streamlined pattern.
2. Brazing Filler Metals: AWS A5.8, Silver Classification BAg-1. Filler metal containing phosphorus is prohibited.

D. Tin-Lined Copper Tube: ASTM B 280, seamless, annealed, with interior tin-plated lining.
1. Copper Fittings: ASME B16.22, wrought copper, streamlined pattern.
2. Brazing Filler Metals: AWS A5.8, Silver Classification BAg-1. Filler metal containing phosphorus is prohibited.

E. Transition Fittings: Type, material, and end connections to match piping being joined.

F. Common Joining Materials: Refer to Division 15 Section "Basic Mechanical Materials and Methods" for joining materials not in this Section.

V. Piping Specialties

A. Flexible Connectors: ANSI Z21.24, copper alloy.

B. Quick-Disconnect Devices: ANSI Z21.41, convenience outlets and matching plug connector.

VI. Specialty Valves

A. Valves, 2” NPS and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.

B. Valves, 2-1/2” NPS and Larger: Flanged ends according to ASME B16.5 for steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

C. Appliance Connector Valves: ANSI Z21.15 and IAS listed.

D. Gas Stops: Bronze body with AGA stamp, plug type with bronze plug and flat or square head, ball type with chrome-plated brass ball and lever handle, or butterfly valve with stainless-steel disc and fluorocarbon elastomer seal and lever handle; 2-psig minimum pressure rating.

E. Gas Valves, 2" NPS and Smaller: ASME B16.33 and IAS-listed bronze body and 125-psig pressure rating.

1. Tamperproof Feature: Include design for locking.

F. Plug Valves, 2-1/2" NPS and Larger: ASME B16.38 and MSS SP-78 cast-iron, lubricated plug valves, with 125-psig pressure rating.

1. Tamperproof Feature: Include design for locking.

G. General-Duty Valves, 2-1/2" NPS and Larger: ASME B16.38, cast-iron body, suitable for fuel gas service, with "WOG" indicated on valve body, and 125-psig pressure rating.

1. Gate Valves: MSS SP-70, OS&Y type with solid wedge.
2. Butterfly Valves: MSS SP-67, lug type with lever handle.

H. Automatic Gas Valves: ANSI Z21.21, with electrical or mechanical operator for actuation by appliance automatic shutoff device.

I. Electrically Operated Gas Valves: UL 429, bronze, aluminum, or cast-iron body solenoid valve; 120-V ac, 60 Hz, Class B, continuous-duty molded coil. Include NEMA ISC 6, Type 4, coil enclosure and electrically opened and closed dual coils. Valve position shall normally be closed.

VII. Pressure Regulators

A. Description: Single stage and suitable for fuel gas service. Include steel jacket and corrosion-resistant components, elevation compensator, and atmospheric vent.

1. 2" NPS and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.
2. 2-1/2" NPS and Larger: Flanged ends according to ASME B16.5 for steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.
3. Service Pressure Regulators: ANSI Z21.80. Include 100-psig- minimum inlet pressure rating.
4. Line Pressure Regulators: ANSI Z21.80 with inlet pressure rating shown on drawings.
5. Appliance Pressure Regulators: ANSI Z21.18. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.

B. Pressure Regulator Vents: Factory- or field-installed, corrosion-resistant screen in opening if not connected to vent piping.

Part 3 - Execution

I. Preparation
   A. Close equipment shutoff valves before turning off fuel gas to premises or section of piping. Perform leakage test as specified in "Field Quality Control" Article to determine that all equipment is turned off in affected piping section.
   B. Comply with ANSI Z223.1, "Prevention of Accidental Ignition" Paragraph.

II. Piping Applications
   A. Flanges, unions, transition, and special fittings with pressure ratings same as or higher than system pressure rating may be used in applications below, unless otherwise indicated.
   B. Fuel Gas Piping, 2 psig or less: Use the following:
      1. Steel pipe, steel welding fittings, and welded joints.

III. Valve Applications
   A. Appliance Shutoff Valves for Pressure 0.5 psig or Less: Appliance connector valve or gas stop.
   B. Appliance Shutoff Valves for Pressure 0.5 to 2 psig: Gas stop or gas valve.
   C. Appliance Shutoff Valves for Pressure 2 to 5 psig: Gas valve.
   D. Piping Line Valves, 2” NPS and Smaller: Gas valve.
   E. Piping Line Valves, 2-1/2” NPS and Larger: Plug valve or general-duty valve.

IV. Piping Installation
   A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation requirements.
   B. Drips and Sediment Traps: Install drips at points where condensate may collect. Include outlets of service meters. Locate where readily accessible for cleaning and emptying.
      1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use minimum-length nipple of 3 pipe diameters, but not less than 3 inches long, and same size as connected pipe. Install with space between bottom of drip and floor for removal of plug or cap.
   C. Install fuel gas piping at uniform grade of 0.1 percent slope upward toward risers.
   D. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
   E. Connect branch piping from top or side of horizontal piping.

F. Install unions in pipes 2” NPS and smaller, adjacent to each valve, at final connection to each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.

G. Install corrugated, stainless-steel tubing system according to manufacturer's written instructions. Include striker plates to protect tubing from puncture where tubing is restrained and cannot move.

H. Install strainer on inlet of each line pressure regulator and automatic and electrically operated valve.

I. Install pressure gage upstream and downstream from each line pressure regulator.

J. Install flanges on valves, specialties, and equipment having 2-1/2” NPS and larger connections.

K. Install vent piping for gas pressure regulators and gas trains, extend outside building, and vent to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end.

V. Joint Construction

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Use materials suitable for fuel gas.

1. Brazed Joints: Make with brazing alloy with melting point greater than 1000 deg F. Brazing alloys containing phosphorus are prohibited.

VI. Hanger And Support Installation

A. Refer to Division 15 Section "Hangers and Supports" for pipe hanger and support devices.

B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. 1” NPS and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
2. 1-1/4” NPS: Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. 1-1/2” NPS and 2” NPS: Maximum span, 108 inches; minimum rod size, 3/8 inch.
4. 2-1/2” NPS to 3-1/2” NPS: Maximum span, 10 feet; minimum rod size, 1/2 inch.
5. 4” NPS and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

C. Install hangers for horizontal hard copper tubing with the following maximum spacing and minimum rod sizes:

1. 3/8” NPS: Maximum span, 48 inches; minimum rod size, 3/8 inch.
2. ½” NPS and 5/8” NPS: Maximum span, 72 inches; minimum rod size, 3/8 inch.

3. ¾” NPS and 7/8” NPS: Maximum span, 84 inches; minimum rod size, 3/8 inch.
4. 1” NPS: Maximum span, 96 inches; minimum rod size, 3/8 inch.

VII. Connections

A. Drawings indicate general arrangement of fuel gas piping, fittings, and specialties.
B. Install piping adjacent to appliances to allow service and maintenance.
C. Connect piping to appliances using gas with shutoff valves and unions. Install valve upstream from and within 72 inches of each appliance. Install union downstream from valve.
D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance using gas.
E. Ground equipment.
   1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
   2. Do not use gas pipe as grounding electrode.

VIII. Labeling And Identifying

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each service meter, pressure regulator, and specialty valve.
   1. Text: In addition to name of identified unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
   2. Refer to Division 15 Section "Mechanical Identification" for nameplates and signs.

IX. Painting

A. Use materials and procedures in Division 9 Section "Painting," "Exterior Paint Schedule" Article, "Ferrous Metal" Paragraph, "Full-Gloss, Alkyd-Enamel Finish" Subparagraph.
B. Paint exterior piping, service meters, pressure regulators, and specialty valves and supports.
   1. Color: Grey.
C. Paint interior piping.
   1. Color: Yellow.

X. Field Quality Control

A. Inspect, test, and purge piping according to ANSI Z223.1, Part 4 "Inspection, Testing, and Purging," and requirements of authorities having jurisdiction.

B. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.
C. Report test results promptly and in writing to Engineer and authorities having jurisdiction.
D. Verify capacities and pressure ratings of service meters, pressure regulators, valves, and specialties.
E. Verify correct pressure settings for pressure regulators.
F. Verify that specified piping tests are complete.

XI. Adjusting

A. Adjust controls and safety devices. Replace damaged and malfunctioning controls and safety devices.

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 -General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope
   A. The work covered under this section shall include a complete fuel oil transfer pumping system.

III. Quality Assurance
   A. The pumping system shall meet the requirements of NFPA 31 - Oil Burning Equipment, state and local codes.
   B. The transfer pump shall be U/L listed for fuel oil use.

IV. Submittals
   A. Provide shop drawings on this equipment as described in Section 230100 - 1.04.

Part 2 - Products

I. Fuel Oil Transfer Pumps
   A. Provide and install a duplex fuel oil pump package as shown on the drawings. Acceptable manufacturers include:
      1. Viking
      2. Tuthill
      3. Webster
      4. Sundstrand.
   B. Type - The pump shall be positive displacement internal gear rotary type in standard cast iron construction. Provide cast iron mounting foot.
   C. Capacity shall be as shown in equipment schedule on drawings.
   D. Rotor - Iron heads shall be hydraulically balanced to assure instant priming and constant flow. Rotor, shaft and idler shall be steel.
   E. Seal - The pump shall employ a mechanical face-type seal, with carbon graphite casing bushing.
   F. Bearings - the bearing shall be Teflon impregnated outboard type.

G. Motor - Pump shall be mounted on formed steel base direct connected through flexible coupling with guard to 1200-rpm open drip-proof motor.

H. Starter - Provide a manual starter for single-phase units and magnetic across-the-line starter for three phase units. The starter shall have ON-OFF switch and red running light. See section 230500, article 2.07.

Part 3 - Execution

I. Installation

A. The fuel oil transfer pumps shall be installed as shown on the drawing and as recommended by the manufacturer.

END OF SECTION

Part 1 - General

I. General

A. The Bidding and Contract Requirements, Division 1 -General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope

A. The work covered under this section shall include a complete installation of a double wall fiberglass underground fuel oil storage tank with an electronic fuel oil gauge, overfill and spill prevention system, hydrostatic tank monitoring system, and all other measures required by local, state, and national governing bodies having jurisdiction over the installation and as shown on the drawings and in the specifications.

III. Quality Assurance

A. The system shall meet the requirements of NFPA 30, “Flammable and Combustible Liquids Code”, and NFPA 31, “Standards for Installation of Fuel Burning Equipment”, Maryland Department of Energy Regulations, and the Prince George’s County building code.

B. The storage tank shall bear a UL label.

C. The complete tank and piping system shall be tested as follows:

1. Primary and secondary tank shall be leak tested by the manufacturer prior to shipment.
2. Leak test primary and secondary tanks before installing in ground. Pressure test primary tank to 5 psig for thirty (30) minutes using gauge pressure to check for leaks. Connect primary and secondary tanks together, pressure test to 5 psig for one hour using gauge pressure to check for leaks. Soap entire tank during this period to check for leaks.
3. After installing the tank in the ground repeat the above tests using gauge pressure to check for leaks.
4. After installation is completed, perform precision test of entire tank and piping system. Test method shall be able to detect leaks of .05 gallons per hour in accordance with Maryland Department of Energy Regulations and NFPA 329.
5. Perform operation test of hydrostatic tank monitoring system by temporarily raising and lowering fluid in annular space.

6. Within 6 months of installation tank must be inspected by a MDE certified inspector.

IV. Submittals

A. Provide shop drawings for tank, piping, and all ancillaries as described in Section 230100, 1.04.

V. Warranty

A. The installed tank specified in this section shall warranted not to fail or leak due to internal or external corrosion or structural damage under normal use and services. If within 30 years from the date of acceptance by the Architect the tank should fail, the manufacturer shall repair or replace it. Installation costs after the first year are not a part of this warranty.

Part 2 - Products

I. Fiberglass-reinforced Polyester Underground Storage Tank

A. Provide and install double-wall storage tank as shown on the drawings. The storage tank shall have corrosion resistant construction of glass fiber reinforcement and isophthalic resin. Capacity and dimensions of the tank shall be as shown on the drawings. The tank shall be manufactured by FLUID CONTAINMENT or XERXES. Tank shall be double wall fiberglass reinforced plastic (FRP) underground storage tank with a primary (internal) tank and a secondary (external) tank.

B. Loading Conditions – Tank shall meet the following design criteria:

1. Internal Load: Primary and secondary tanks shall withstand 5 psi air pressure test with 5 to 1 safety factor.
2. Vacuum Test: Tank shall be vacuum tested by the tank manufacturer to assure structural integrity. Primary tank shall be tested to 11.5 inches mercury and secondary tank tested to 9.5 inches mercury vacuum.
3. Surface Loads: Tank shall withstand surface H-20 axle loads when properly installed according to current manufacturer’s installation instructions.
4. External hydrostatic pressure: Buried in ground with 7’ of overburden over the top of the tank, the hole flooded and a safety factor of 5:1 against general buckling.
5. Tank shall be designed to support accessory equipment such as drop tubes when installed according to manufacturer’s recommendations and limitations.

C. Product Storage Requirements

1. Tanks shall be capable of storing petroleum with specific gravity up to 1.1, shall be chemically inert to petroleum products, and shall be capable of storing fuel oil at temperatures not to exceed 150 degrees F.
2. The primary tank shall be vented to atmospheric pressure. The tank is not designed as a pressure vessel.

D. Materials – Tanks (primary and secondary) shall be manufactured with 100% isophthalic polyester resin and glass fiber reinforcement with no sand fillers.

E. Brine Filled Annular Space – Tank shall have a space between the primary and secondary shell walls to allow for the free flow and containment of all leaked product from the primary tank.

II. Tank Accessories

A. Anchor straps – Provide FRP anchor straps as manufactured by tank manufacturer. Number and location of straps shall be specified in current literature of tank manufacturer. Each strap shall be capable of withstanding the buoyancy load for tank diameter as follows:
1. 4’-4,200 lbs. 8’-25,000 lbs. 12’-26,000 lbs.
2. 6’-18,000 lbs. 10’-32,000 lbs.

B. Tank Flanged Manway shall be 22” I.D. flanged complete with U.L. listed gaskets, bolts and covers.

C. Gauge Plates shall be installed by the manufacturer under each fitting and manway to prevent damage from dipstick abuse and ladders.

D. Annular Space
1. Tank shall have a space between the primary and secondary shell walls to allow for the free flow and containment of all leaked product from the primary tank.
2. Tank shall have one 4” NPT fitting located at each end of the tank for monitoring access to the space between the primary and secondary shell walls. Tank shall also include one 4” NPT fitting in the reservoir on the top of the tank.

E. NPT Threaded Fittings
1. All threaded fittings shall be a material of construction consistent with the requirements of the U.L. label. Fittings shall withstand a minimum of 150 foot pounds of torque and 1000 foot pounds of bending both with 2:1 factor of safety.
2. All standard thread fittings shall be half couplings and shall be 4” in diameter. Reducers are to be used for smaller sizes where shown and provided by contractor.

3. Suction Line – Shall be installed by contractor on site. Pipes shall terminate a minimum of 4” from bottom of tank.
4. Return line shall be installed by contractor and shall terminate at the top of the tank.

F. Hydrostatic Monitor Reservoir – An integrally mounted reservoir installed by the manufacturer shall be installed on the top of the tank. Reservoir shall be constructed of fiberglass reinforced plastic and shall have a 4” NPT monitoring fitting on top.

G. Deadman Anchors – Deadman shall be a concrete beam with a total length 12” greater than the length of the tank. Deadman for 6’ and 8’ diameter tanks shall be 12” X 12” and deadman for 10’ diameter tanks shall be 24” X 18”.

H. Certification Plate – Underwriter Laboratory label shall be permanently affixed to tank.

I. Lifting Lugs – Provide lifting lugs on tank. Lugs shall be capable of withstanding weight of tank with a safety factor of 3 to 1.

J. On 4,000 gallon tanks only, the Contractor shall install a foot valve in the supply line inside of the oil tank. The valve shall be single poppet style with an 8-mesh protective screen. Prototype: OPW model 91.

III. Fuel Oil Gauge System

A. The fuel oil gauge system shall consist of a liquid level transducer in the tank with an electronic indicator mounted in the boiler room complete with all necessary wiring. The tank gauging system shall be Hersey Model VR-2 transducer and model 5000 indicator or equal by Pneumercator or Petrometer, providing all aspects of the following are met:

1. The liquid level transducer shall extend to the bottom of the tank with the connection section mounted on the top outer tank shell. The transducer shall convert the position of a floating magnet to a variable resistive signal output to the indicator. The transducer shall be enclosed in a stainless steel housing, have a resolution of 1/8”, include zener barriers for intrinsically safe operation, and be Factory Mutual approved for fuel oil tanks.
2. The electronic indicator shall be compatible with level transducer and have a calibrated 250°F 10-1/2 inch diameter dial, an accuracy of 1.5% full scale, a standard proportional 4-20 mA output, an integral terminal connection block, and four alarm contacts. Power supply to the unit shall be 115 volt and low voltage power supply shall be internal to the unit. The indicator shall in a NEMA 3R housing and surface mounted in the boiler room. Wiring between the transmitter and the indicator and from the 115 volt power source to the indicator shall be under this section of the specifications.

3. Buried conduit for fuel oil gauge and reservoir sensor conductors shall be ¾" non-metallic. Conduit exposed in manhole shall be rigid metallic. Conduit within the boiler room shall be rigid metallic or IMC. Junction boxes shall be in manholes and shall be NEMA type 6, submersible watertight. Minimum conductor size shall be AWG #18 type THHN.

IV. Overfill And Spill Prevention System

A. The overfill and spill prevention system shall consist of an automatic overfill prevention valve, a spill containment basin, product fill tube, and manhole with lid and lockable fill cap. Overfill and spill prevention shall be the product of a single manufacturer. System shall be Emco/Wheaton model A1000 or equal provided all aspects of this specification are met. Components shall meet the following:

1. Overfill Prevention Valve – Valve shall be mounted within the spill containment basin for access. Valve shall shut off flow when the tank is 95% full, have a two-stage reset, a test button, and a spill basin drain assembly. Valve shall be cast aluminum with teflon floats protected with a shroud, with buna seals and 4" NPT fittings on each end. Prototype: OPW 61-60 overfill valve with drop tube, fill adapter and lockable cap.
2. Spill Prevention Basin – Basin shall have a 5 gallon capacity and shall contain an expandable inner shield within a rigid outer housing. The overfill prevention valve shall be mounted in the inner shield of the basin. Basin shall be constructed of fuel resistant plastic. Prototype: EMCO/WHEATON Model A1003.
3. Fill Tube – Tube shall be supplied with the overfill prevention valve, shall be aluminum, and shall extend to 4" from the bottom of the tank.
4. Manhole Cover – Manhole shall be cast iron or aluminum and be capable of a 7-1/2 ton bearing load. Paint the cover green.
5. Fill Tube Cap – Cap shall be water tight and lockable.
6. Sound Line Cap – Cap shall be watertight and oil wrench operated. Provide one oil wrench for the Owners use. Mount the wrench on the wall next to the fuel oil gauge or monitoring system.

V. Hydrostatic Tank Monitoring

A. The hydrostatic tank monitoring system shall be supplied by the tank manufacturer and shall consist of a brine solution in the annular space between tanks, a level sensor in the monitoring reservoir, an alarm panel, and all necessary wiring. The monitoring system shall be capable of detecting a leak in the primary and/or secondary tank as small as .05

gallons per hour regardless of the oil level in the tank or ground water conditions. Components shall be as follows:

1. Brine Solution - The annular space between tanks shall be filled with environmentally safe, non-toxic brine solution able to provide freeze protection to minus 40 degrees F and UL listed for compatibility with the tank.
2. Level Sensor - The sensor shall be mounted in the monitoring reservoir on the tank and shall complete a circuit to generate alarm signals for normal, high, and low brine levels.
3. Alarm Panel - The alarm panel shall have a 120 volt power source. The panel shall have a normal operation lamp, an alarm indicator lamp, a bell alarm, a test button, a silencing switch, terminal contacts for external monitoring, two spare light bulbs, NEMA 2 enclosure, and a hasp for a padlock. Each lamp or switch shall be permanently labeled. A wiring diagram for the monitoring system shall be provided.

VI. Vent Cap

A. The fuel oil tank vent line shall be extended to at least ten (10) feet above grade. Provide a rain roof cap on vent opening.

VII. Manhole Cover

A. Manholes shall be 30" diameter, round with cast iron lid and steel rim. Manholes shall be set in 8" thick concrete extending at least 18" in all directions. Concrete shall slope away from hole to ensure drainage.

VIII. Manway Risers

A. Riser shall be fiberglass, 48" diameter. Bottom of riser shall be within 6" of top of the tank.

IX. Tank Nameplate

A. Provide an engraved aluminum or brass nameplate (minimum 10” x 8”) permanently mounted in the concrete at the tank fill valve or on the building adjacent to the trench. Nameplate shall state the following: “TANK CAPACITY IN GALLONS”, DIAMETER OF TANK”, “TANK MANUFACTURER”, “TANK U/L #”, “DATE OF INSTALLATION”, “TYPE OF FUEL”, “TANK #” (if more than one tank). Engraved letters shall be one inch high.

Part 3 - Execution

I. Fuel Oil Tank

A. Tank shall be installed according to current installation instructions provided by the manufacturer. Tank system shall be tested according to manufacturer's instruction and part 1.03 of this section.

B. A 12 inch deep layer of pea gravel (1/8" to 3/4" diameter) or fine stone crushings (1/8" to 1/2" diameter) (ASTM D-448 & C-33-9.1) shall be spread evenly under the entire tank as a bed to separate the tank from the earth.

C. Before placing the tank in the excavation, all dirt clods and similar foreign matter shall be cleaned from the tank and areas of coating damages shall be repaired with a compatible coating.

D. Equipment to lift the tank shall be of adequate size to lift and lower the tank without dragging or dropping to ensure do damage to the tank. Tanks shall be carefully lifted and lowered by use of cables of adequate length attached where recommended by the manufacturer. Under no circumstances will chains or slings around the tank shell be used.

E. Special care should be exercised when installing hold down straps to ensure that the straps are separated from the tanks by separating pad made of an inert insulating material. The separating pad should be at least 2 inches wider than hold down straps width and must be carefully placed anywhere on the tank where hold down straps would come into direct contact with the tank shell.

F. Backfill consisting of pea fine gravel or #8 crushed stone shall be placed along bottom sides of tank by shoveling and tamping to ensure the tank is fully and evenly supported around bottom quadrant. The backfill shall be deposited carefully around tank and to a depth over tank shown on the drawings.

G. The plugs at unused tank openings, shall be removed; a pipe compound shall be added, and the plugs shall be reinstalled in the unused openings. The plugs in tank openings which are to be used should not be over tightened as this may cause the bushing thread or damage the non-metallic bushings when replacing plugs or installing required tank piping.

H. Anchoring - Concrete pad or Deadman as shown on plans shall be located and installed as recommended by the tank manufacturer.

I. The tank shall be filled to 100% of capacity with new number 2 fuel oil.

II. Ancillary Equipment

A. All ancillary equipment including the fuel oil gauge system, overfill and spill prevention system, hydrostatic tank monitoring system, vent caps manholes, etc. shall be installed in accordance with the manufacturer's instructions.

III. Installation Contractor

A. The storage tank system shall be installed by experienced mechanics regularly employed by a specialty contractor that is in the full time business of designing and installing petroleum storage tank and fuel dispensing systems. Contractor shall be an MDE certified UST technician. The contractor shall have a minimum of five (5) years successful history in the design, installation, and maintenance of petroleum storage systems. Submit a written description of the firm's experience and a listing of at least three (3) of its installations of a comparable size and complexity.

IV. Tank Installation Documentation

A. Contractor shall provide the Owner with the following information for each tank installed within thirty days after installation.

1. Facility address.
2. Fire Marshall or other installation inspection reports.
3. Manufacturers installation instruction sheet with UL# and procedures checked.
4. MSDS sheets on materials supplied.
5. Precision test results.
6. Copy of approved drawings and permit from local building authority.

END OF SECTION

Fuel Oil Underground Storage Tank Removal
Section 231315

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 -General Requirements, Section 230100 - General Provisions shall apply to this section.

II. Scope
   A. The work covered under this section shall include the removal of the existing underground fuel oil storage tank and associated piping, and all other measures required by local, state, and national governing bodies having jurisdiction over the existing installation and as shown on the drawings and in the specifications.
   B. The oil tank area shall be restored to grade and re-paved.

III. Quality Assurance
   A. The demolition/removal shall meet the requirements of the Maryland Department of Energy Regulations for underground storage tanks; Prince George's County building code, and Fire Marshal Regulations.

Part 2 - Products

I. Backfill
   A. Backfill shall be installed in accordance with Division 31.

II. Pavement And Subbase
   A. Pavement and Subbase shall be installed in accordance with Division 32.

Part 3 - Execution

I. Fuel Oil Tank And Pipe Removal:
   A. Contractor shall remove and dispose of the existing fuel oil tank, concrete pad, and soil in a manner as required and approved by all federal, state, and local agencies. The contractor shall be responsible for the removal of ten inches (10") or less of oil/water in the tank. Additional liquid will be disposed of at an additional cost to PGCPS. A Certificate of Compliance with these requirements shall be submitted to the Owner.
   B. Contractor shall remove and dispose of the existing oil piping in the boiler room, and any piping within the tank excavation area. Remaining underground oil piping shall be drained and abandoned in place.

C. If evidence of contamination exists (as determined by the Fire Marshal Official, or by soil tests submitted to the state) the Contractor shall immediately notify the Owner and take necessary steps to limit any future contamination of surroundings. The state and local governing authorities will dictate corrective action to be taken subject to guidelines established by The Environmental Protection Agency. Corrective actions will be done by change order to the contract.

D. Any additional or backfill soil shall be free of all debris and shall be compacted to 95 percent density. Contractor shall be responsible for providing all backfill soil. See Division 31.

E. All tank cleaning and disposal costs shall be included in contract price.

F. Prior to removal of existing underground fuel oil tank, the Contractor shall notify the office of the Fire Marshal and obtain all necessary permits.

G. An official from the office of the Fire Marshal will witness the tank removal and, subject to his determination, backfilling of excavation shall be permitted or denied.

H. Excavated soil shall be piled in multiple piles by soil condition at an Owner approved location either on site within property or at a site provided by Contractor. Costs for loading, hauling, and dumping shall be included in the bid. Pile(s) shall be on plastic sheets with seams taped and surrounded by hay bales.

II. Existing Utilities

A. The Contractor shall contact “Miss Utility” to determine the location of any conflicting utilities in the oil tank excavation area. Provide adequate means of protection during earthwork operations of any utilities.

B. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, the Contractor shall notify the Owner’s Representative immediately.

C. The Contractor shall not move or interrupt existing utilities without first coordinating with the Owner’s Representative.

III. Excavation, Sheeting, Shoring, And Bracing

A. Existing asphalt and concrete surface shall be cut neatly and cleanly.

B. Stability of Sides: Slope sides of excavations over 4' deep to angle of response of material excavated; otherwise, shore and brace where sloping is not possible either because of space restrictions, stability of material excavated or nearby utilities.

1. Maintain sides and slopes of excavations in a safe condition until completion of backfilling by scaling, benching, shelving or bracing.

2. Take precautions to prevent slides or cave-ins when excavations are made in locations adjacent to backfilled excavations, and when sides of excavations are subjected to vibrations from vehicular traffic or the operation of machinery, or any other source.

C. Shoring and Bracing shall be installed in accordance with Division 31.

IV. Backfill

A. Backfill shall be installed in accordance with section Division 31.

V. Pavement And Subbase

A. Pavement and Subbase shall be installed in accordance with Division 32.

VI. Barricades, Warning Signs And Lights

A. Comply with recognized standards and code requirements for the erection of substantial, structurally adequate barricades where needed to prevent accidents and losses. Paint with appropriate colors, graphics and warning signs to inform personnel at the site and the public, of the hazard being protected against. Provide lighting where appropriate and needed, including flashing red lights where appropriate.

VII. Enclosure Fence

A. When excavation or other substantial elements of the work begin, install a general enclosure fence with suitable lockable entrance gates. Enclose substantially the entire site or portion thereof determined to be sufficient to accommodate the entire construction operation. Install fence in a manner that will prevent persons, dogs and similar animals from easily entering the site. Fence shall be a minimum height of 6 feet.

END OF SECTION

Part 1 - General

I. Related Documents
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

II. Summary
   A. This Section includes piping, special-duty valves, and hydronic specialties for hot-water heating, chilled-water cooling, and condenser water systems; makeup water for these systems; blowdown drain lines; and condensate drain piping.
   B. Related Sections include the following:
      1. Division 23 Section "Basic Mechanical Materials and Methods" for general piping materials and installation requirements.
      2. Division 23 Section "Hangers and Supports" for pipe supports, product descriptions, and installation requirements. Hanger and support spacing is specified in this Section.
      3. Division 23 Section "Valves" for general-duty gate, globe, ball, butterfly, and check valves.
      4. Division 23 Section "Meters and Gages" for thermometers, flow meters, and pressure gages.
      5. Division 23 Section "Mechanical Identification" for labeling and identifying hydronic piping.
      6. Division 23 Section "Hydronic Pumps" for pumps, motors, and accessories for hydronic piping.
      7. Division 23 Section "HVAC Instrumentation and Controls" for temperature-control valves and sensors.

III. Definitions
   A. PVC: Chlorinated polyvinyl chloride.
   B. PVC: Polyvinyl chloride.

IV. Submittals
   A. Product Data: For each type of special-duty valve indicated. Include flow and pressure drop curves based on manufacturer's testing for diverting fittings, calibrated balancing valves, and automatic flow-control valves.

B. Shop Drawings: Detail fabrication of pipe anchors, hangers, special pipe support assemblies, alignment guides, expansion joints and loops, and their attachment to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

C. Welding Certificates: Copies of certificates for welding procedures and personnel.

D. Field Test Reports: Written reports of tests specified in Part 3 of this Section. Include the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Failed test results and corrective action taken to achieve requirements.

E. Maintenance Data: For hydronic specialties and special-duty valves to include in maintenance manuals specified in Division 1.

F. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

V. Quality Assurance

A. Welding: Qualify processes and operators according to the ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

VI. Coordination

A. Coordinate layout and installation of hydronic piping and suspension system components with other construction, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

B. Coordinate pipe sleeve installations for foundation wall penetrations.

C. Coordinate piping installation with roof curbs, equipment supports, and roof penetrations. Roof specialties are specified in Division 7 Sections.

D. Coordinate pipe fitting pressure classes with products specified in related Sections.

E. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base.

F. Coordinate installation of pipe sleeves for penetrations through exterior walls and floor assemblies.

VII. Extra Materials

A. Water Treatment Chemicals: Furnish sufficient chemicals for initial system startup and for preventive maintenance for one year from date of Substantial Completion.

Part 2 - Products

I. Manufacturers

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Calibrated Balancing Valves:
   a) Armstrong Pumps, Inc.
   b) Flow Design, Inc.
   c) ITT Bell & Gossett; ITT Fluid Technology Corp.
   d) Taco, Inc.
2. Pressure-Reducing Valves:
   a) Amtrol, Inc.
   b) Armstrong Pumps, Inc.
   c) Conbraco Industries, Inc.
   d) ITT Bell & Gossett; ITT Fluid Technology Corp.
   e) Spence Engineering Company, Inc.
   f) Watts Industries, Inc.; Watts Regulators.
3. Safety Valves:
   a) Amtrol, Inc.
   b) Armstrong Pumps, Inc.
   c) Conbraco Industries, Inc.
   d) ITT McDonnell & Miller Div.; ITT Fluid Technology Corp.
   e) Kunkle Valve Division.
   f) Spence Engineering Company, Inc.
4. Expansion Tanks:
   a) Amtrol, Inc.
   b) Armstrong Pumps, Inc.
   c) ITT Bell & Gossett; ITT Fluid Technology Corp.
   d) Taco, Inc.
   e) Wessels
5. Air Separators and Air Purgers:
   a) Amtrol, Inc.
   b) Armstrong Pumps, Inc.

c) ITT Bell & Gossett; ITT Fluid Technology Corp.

d) Taco, Inc.

e) Wessels

II. Piping Materials

A. General: Refer to Part 3 "Piping Applications" Article for applications of pipe and fitting materials.

III. Copper Tube And Fittings

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.

B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.

C. DWV Copper Tubing: ASTM B 306, Type DWV.

D. Wrought-Copper Fittings: ASME B16.22.

E. Wrought-Copper Unions: ASME B16.22.

F. Solder Filler Metals: ASTM B 32, 95-5 tin antimony or 100% lead free.

G. Brazing Filler Metals: AWS A5.8, Classification BAg-1 (silver).

IV. Steel Pipe And Fittings

A. Steel Pipe, NPS 2 and Smaller: ASTM A 53, Type S (seamless) or Type F (furnace-butt welded), Grade B, Schedule 40, black steel, plain ends.

B. Steel Pipe, NPS 2-1/2 through NPS 12: ASTM A 53, Type E (electric-resistance welded), Grade B, Schedule 40, black steel, plain ends.

1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53, Schedule 40, black steel; seamless for NPS 2 and smaller and electric-resistance welded for NPS 2-1/2 and larger.

C. Black Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250.

D. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300.

E. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300.

F. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced.

G. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

H. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.

2. End Connections: Butt welding.

3. Facings: Raised face.

I. Flexible Connectors: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket; 150-psig minimum working pressure and 250 deg F maximum operating

temperature. Connectors shall have flanged or threaded-end connections to match equipment connected and shall be capable of 3/4-inch misalignment.

J. Welding Materials: Comply with Section II, Part C, of the ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.

K. Gasket Material: Thickness, material, and type suitable for fluid to be handled; and design temperatures and pressures.

V. Plastic Pipe And Fittings

A. PVC Plastic Pipe: ASTM D 1785, Schedules 40 and 80, plain ends.

B. PVC Plastic Pipe Fittings: Socket-type pipe fittings, ASTM D 2466 for Schedule 40 pipe; ASTM D 2467 for Schedule 80 pipe.

1. PVC Solvent Cement: ASTM D 2564.

VI. Valves

A. Gate, globe, check, ball, butterfly, and outside stem and yoke valves are specified in Division 15 Section "Valves."

B. Refer to Part 3 "Valve Applications" Article for applications of each valve.

C. Calibrated Balancing Valves, NPS 2” and Smaller: Bronze body, ball type, 125-psig working pressure, 250 deg F maximum operating temperature, and having threaded ends. Valves shall have calibrated orifice or venturi, connections for portable differential pressure meter with integral seals, and be equipped with a memory stop to retain set position.

D. Calibrated Balancing Valves, NPS 2-½” and Larger: Cast-iron or steel body, ball type, 125-psig working pressure, 250 deg F maximum operating temperature, and having flanged connections. Valves shall have calibrated orifice or venturi, connections for portable differential pressure meter with integral seals, and be equipped with a memory stop to retain set position.

E. Pressure-Reducing Valves: Diaphragm-operated, bronze or brass body with low inlet pressure check valve, inlet strainer removable without system shutdown, and non-corrosive valve seat and stem. Select valve size, capacity, and operating pressure to suit system. Valve shall be factory set at operating pressure and have capability for field adjustment.

F. Safety Valves: Diaphragm-operated, bronze or brass body with brass and rubber, wetted, internal working parts; shall suit system pressure and heat capacity and shall comply with the ASME Boiler and Pressure Vessel Code, Section IV.

VII. Hydronic Specialties

A. Manual Air Vent: Bronze body and nonferrous internal parts; 150-psig working pressure; 225 deg F operating temperature; manually operated with screwdriver or thumbscrew; with NPS 1/8 discharge connection and NPS 1/2 inlet connection.

B. Automatic Air Vent: Designed to vent automatically with float principle; bronze body and nonferrous internal parts; 150-psig working pressure; 240 deg F operating temperature; with NPS 1/4 discharge connection and NPS 1/2 inlet connection.

C. Expansion Tanks: Welded carbon steel, rated for 125-psig working pressure and 375 deg F1 deg C) maximum operating temperature, with taps in bottom of tank for tank fitting and taps in end of tank for gage glass. Tanks shall be factory tested with taps fabricated and labeled according to the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1. Include the following fittings and accessories:

1. Air-Control Tank Fitting: Cast-iron body, copper-plated tube, brass vent tube plug, and stainless-steel ball check, 100-gal. unit only; sized for compression-tank diameter. Design tank fittings for 125-psig working pressure and 250 deg F maximum operating temperature.
2. Tank Drain Fitting: Brass body, nonferrous internal parts; 125-psig working pressure and 240 deg F maximum operating temperature; designed to admit air to compression tank, drain water, and close off system.
3. Gage Glass: Full height with dual manual shutoff valves, 3/4-inch- diameter gage glass, and slotted-metal glass guard.

D. Tangential-Type Air Separators: Welded black steel; ASME constructed and labeled for 125-psig minimum working pressure and 375 deg F maximum operating temperature; perforated stainless-steel air collector tube designed to direct released air into expansion tank; tangential inlet and outlet connections; threaded connections for NPS 2” and smaller; flanged connections for NPS 2-½” and larger; threaded blowdown connection. Provide units in sizes for full-system flow capacity.

E. In-Line Air Separators: One-piece cast iron with an integral weir designed to decelerate system flow to maximize air separation at a working pressure up to 175 psig and liquid temperature up to 300 deg F.

F. Air Purgers: Cast-iron body with internal baffles that slow the water velocity to separate the air from solution and divert it to the vent for quick removal. Maximum working pressure of 150 psig and temperature of 250 deg F.

G. Bypass Chemical Feeder: Welded steel construction; 125-psig working pressure; 5-gal. capacity; with fill funnel and inlet, outlet, and drain valves.
   1. Chemicals: Specially formulated, based on analysis of makeup water, to prevent accumulation of scale and corrosion in piping and connected equipment.

H. Y-Pattern Strainers: 125-psig working pressure; cast-iron body (ASTM A 126, Class B), flanged ends for NPS 2-½" and larger, threaded connections for NPS 2" and smaller, bolted cover, perforated stainless-steel basket, and bottom drain connection.

I. Flexible Connectors: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket; 150-psig minimum working pressure and 250 deg F maximum operating temperature. Connectors shall have flanged- or threaded-end connections to match equipment connected and shall be capable of 3/4-inch misalignment.

Part 3 - Execution

I. Piping Applications
   A. Hot and Chilled Water, NPS 2" and Smaller: Above ground, use Type L drawn-temper copper tubing with soldered joints or Schedule 40 steel pipe with threaded joints.
   B. Hot and Chilled Water, NPS 2-½" and Larger: Schedule 40 steel pipe with welded and flanged joints.
   C. Condenser Water: Schedule 80 PVC pipe with solvent-welded joints.

II. Valve Applications
   A. General-Duty Valve Applications: Unless otherwise indicated, use the following valve types:
      1. Shutoff Duty: Gate, ball, and butterfly valves.
      2. Throttling Duty: Globe, ball, and butterfly valves.
   B. Concealed valve location identifiers on site shall be metal tag type attached to drop ceiling structure or identified by permanent tag on wall under hard ceilings directly under valve.
   C. Install shutoff duty valves at each branch connection to supply mains, at supply connection to each piece of equipment, unless only one piece of equipment is connected in the branch line. Install throttling duty valves at each branch connection to return mains, at return connections to each piece of equipment, and elsewhere as indicated.
   D. Install calibrated balancing valves in the return water line of each heating or cooling element and elsewhere as required to facilitate system balancing.
   E. Install check valves at each pump discharge and elsewhere as required to control flow direction.

F. Install safety valves on hot-water generators and elsewhere as required by the ASME Boiler and Pressure Vessel Code. Install safety-valve discharge piping, without valves, to floor. Comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, for installation requirements.

G. Install pressure-reducing valves on hot-water generators and elsewhere as required to regulate system pressure.

III. Piping Installations

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation requirements.

B. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

C. Install drains, consisting of a tee fitting, NPS 3/4” ball valve, and short NPS 3/4” threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

D. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

E. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

F. Unless otherwise indicated, install branch connections to mains using tee fittings in main pipe, with the takeoff coming out the bottom of the main pipe. For up-feed risers, install the takeoff coming out the top of the main pipe.

G. Install strainers on supply side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4” nipple and ball valve in blowdown connection of strainers NPS 2” and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2”.

H. Anchor piping for proper direction of expansion and contraction.

IV. Hangers And Supports

A. Hanger, support, and anchor devices are specified in Division 15 Section "Hangers and Supports." Comply with requirements below for maximum spacing of supports.

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.

5. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
   1. NPS 3/4": Maximum span, 7 feet; minimum rod size, 1/4 inch.
   2. NPS 1": Maximum span, 7 feet; minimum rod size, 1/4 inch.
   3. NPS 1-½": Maximum span, 9 feet; minimum rod size, 3/8 inch.
   4. NPS 2": Maximum span, 10 feet; minimum rod size, 3/8 inch.
   5. NPS 2-½": Maximum span, 11 feet; minimum rod size, 3/8 inch.
   6. NPS 3": Maximum span, 12 feet; minimum rod size, 3/8 inch.
   7. NPS 4": Maximum span, 14 feet; minimum rod size, 1/2 inch.
   8. NPS 6": Maximum span, 17 feet; minimum rod size, 1/2 inch.
   9. NPS 8": Maximum span, 19 feet; minimum rod size, 5/8 inch.
   10. NPS 10": Maximum span, 20 feet; minimum rod size, 3/4 inch.
   11. NPS 12": Maximum span, 23 feet; minimum rod size, 7/8 inch22 mm).
   12. NPS 14": Maximum span, 25 feet; minimum rod size, 1 inch.
   13. NPS 16": Maximum span, 27 feet; minimum rod size, 1 inch.
   14. NPS 18": Maximum span, 28 feet; minimum rod size, 1-1/4 inches2 mm).
   15. NPS 20": Maximum span, 30 feet; minimum rod size, 1-1/4 inches.

D. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
   1. NPS 3/4": Maximum span, 5 feet; minimum rod size, 1/4 inch.
   2. NPS 1": Maximum span, 6 feet; minimum rod size, 1/4 inch.
   3. NPS 1-½": Maximum span, 8 feet; minimum rod size, 3/8 inch.
   4. NPS 2": Maximum span, 8 feet; minimum rod size, 3/8 inch.
   5. NPS 2-½": Maximum span, 9 feet; minimum rod size, 3/8 inch.
   6. NPS 3": Maximum span, 10 feet; minimum rod size, 3/8 inch.

E. Plastic Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.

F. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

V. Pipe Joint Construction

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for joint construction requirements for soldered and brazed joints in copper tubing; threaded, welded, and flanged joints in steel piping; and solvent-welded joints for PVC piping.

VI. Hydronic Specialties Installation

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install automatic air vents in mechanical equipment rooms only at high points of system piping, at heat-transfer coils, and elsewhere as required for system air venting.

C. Install dip-tube fittings in boiler outlet. Install piping to expansion tank with a 2 percent upward slope toward tank. Connect boiler-outlet piping.

D. Install in-line air separators in pump suction lines. Install piping to compression tank with a 2 percent upward slope toward tank. Install drain valve on units NPS 2" and larger.

E. Install combination air separator and strainer in pump suction lines. Install piping to compression tank with a 2 percent upward slope toward tank. Install blowdown piping with gate valve; extend to nearest drain.

F. Install bypass chemical feeders in each hydronic system where indicated, in upright position with top of funnel not more than 48 inches above floor. Install feeder in bypass line, off main, using globe valves on each side of feeder and in the main between bypass connections. Pipe drain, with ball valve, to nearest equipment drain.

G. Install expansion tanks above air separator. Install gage glass and cocks on end of tank. Install tank fitting in tank bottom and charge tank. Use manual vent for initial fill to establish proper water level in tank.

1. Support tank from floor or structure above with sufficient strength to carry weight of tank, piping connections, and fittings, plus weight of a full tank of water. Do not overload building components and structural members.

VII. Terminal Equipment Connections

A. Size for supply and return piping connections shall be same as for equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If multiple, parallel control valves are installed, only one bypass is required.

D. Install ports for pressure and temperature gages at coil inlet connections.

VIII. Field Quality Control

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.

2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.

3. Flush system with clean water. Clean strainers.

4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:
1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release trapped air. Use drains installed at low points for complete draining of liquid.
3. Check expansion tanks to determine that they are not air bound and that system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the design pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed either 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A of ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

IX. Adjusting

A. Mark calibrated nameplates of pump discharge valves after hydronic system balancing has been completed, to permanently indicate final balanced position.

B. Perform these adjustments before operating the system:
1. Open valves to fully open position. Close coil bypass valves.
2. Check pump for proper direction of rotation.
3. Set automatic fill valves for required system pressure.
4. Check air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Check operation of automatic bypass valves.

7. Check and set operating temperatures of boilers and chillers to design requirements.
8. Lubricate motors and bearings.

X. Cleaning

A. Flush hydronic piping systems with clean water. Remove and clean or replace strainer screens. After cleaning and flushing hydronic piping systems, but before balancing, remove disposable fine-mesh strainers in pump suction diffusers.

END OF SECTION

Part 1 - General

I. Related Documents
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

II. Summary
   A. This Section includes the following categories of hydronic pumps for hydronic systems:
      1. In-line circulators.
      2. Vertical in-line pumps.
      3. End-suction pumps.
      4. Double-suction pumps.
      5. Automatic condensate pump units.
   B. Related Sections include the following:
      1. Division 15 Section "Motors" for general motor requirements.

III. Submittals
   A. Product Data: Include certified performance curves and rated capacities; shipping, installed, and operating weights; furnished specialties; final impeller dimensions; and accessories for each type of product indicated. Indicate pump's operating point on curves.
   B. Shop Drawings: Show pump layout and connections. Include Setting Drawings with templates for installing foundation and anchor bolts and other anchorages.
      1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.
   C. Maintenance Data: For pumps to include in maintenance manuals specified in Division 1.

IV. Quality Assurance
   A. UL Compliance: Fabricate and label pumps to comply with UL 778, "Motor-Operated Water Pumps," for construction requirements.
   B. Product Options: Drawings indicate size, profiles, connections, and dimensional requirements of pumps and are based on the specific types and models indicated. Other manufacturers' pumps with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."
   C. Regulatory Requirements: Fabricate and test steam condensate pumps to comply with HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation," and HI 1.6, "Centrifugal Pump Tests."

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

V. Delivery, Storage, And Handling

A. Manufacturer's Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anticorrosion compound after assembly and testing. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.

B. Store pumps in dry location.

C. Retain protective covers for flanges and protective coatings during storage.

D. Protect bearings and couplings against damage from sand, grit, and other foreign matter.

E. Comply with pump manufacturer's written rigging instructions.

VI. Coordination

A. Coordinate size and location of concrete bases.

VII. Extra Materials

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Mechanical Seals: One mechanical seal for each pump.

Part 2 - Products

I. Manufacturers

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. In-Line Circulators:
   a) Armstrong Pumps, Inc.
   b) Bell & Gossett ITT; Div. of ITT Fluid Technology Corp.
   c) Taco; Fabricated Products Div.
2. Compact In-Line Circulators:
   a) Armstrong Pumps, Inc.
   b) Bell & Gossett ITT; Div. of ITT Fluid Technology Corp.
   c) Taco; Fabricated Products Div.
3. Vertical In-Line Pumps:
   a) Armstrong Pumps, Inc.
   b) Bell & Gossett ITT; Div. of ITT Fluid Technology Corp.
   c) Taco; Fabricated Products Div.

4. Supported-Volute, Flexible-Coupled, End-Suction Pumps:
    a) Armstrong Pumps, Inc.
    b) Bell & Gossett ITT; Div. of ITT Fluid Technology Corp.
    c) Taco; Fabricated Products Div.

II. General Pump Requirements

A. Pump Units: Factory assembled and tested.

B. Motors: Include built-in, thermal-overload protection and grease-lubricated ball bearings. Select each motor to be non-overloading over full range of pump performance curve.

C. Motors Indicated to Be Energy Efficient: Minimum efficiency as indicated according to IEEE 112, Test Method B. Include motors with higher efficiency than "average standard industry motors" according to IEEE 112, Test Method B, if efficiency is not indicated.

D. Warranty: Provide pumps with five year warranty for manufacturer or installation defects.

III. In-line Circulators

A. Description: Horizontal, in-line, centrifugal, single-stage, bronze-fitted, radially split case design; rated for 125-psig minimum working pressure and a continuous water temperature of 225 deg F.

1. Casing: Cast iron, with threaded companion flanges for piping connections, and threaded gage tappings at inlet and outlet connections.
    a) Connection Option: Unions at connections for casings that are not available with threaded companion flanges.
2. Impeller: ASTM B 584, cast bronze, statically and dynamically balanced, closed, overhung, single suction, and keyed to shaft.
3. Shaft and Sleeve: Steel shaft with oil-lubricated copper sleeve.
4. Seals: Mechanical type. Include carbon-steel rotating ring, stainless-steel spring, ceramic seat, and flexible bellows and gasket.
5. Pump Bearings: Oil-lubricated, bronze journal and thrust type.
6. Motor Bearings: Oil-lubricated, sleeve type.
7. Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.
8. Motor: Resiliently mounted to pump casing.

IV. Compact In-line Circulators

A. Description: Water cooled, horizontal, in-line, compact design, seal-less, centrifugal, and single stage. Include pump and motor assembled on a common shaft in hermetically sealed unit, without stuffing boxes or mechanical seals. Include lubrication of sleeve bearing and cooling of motor by circulating pumped liquid through motor section, and

isolation of motor section from motor-stator windings by corrosion-resistant, nonmagnetic, alloy liner. Include design rated for 125-psig minimum working pressure and a continuous water temperature of 225 deg F.

B. Description: Cartridge type, horizontal, in-line, compact, seal-less, centrifugal, and single stage. Include pump and motor assembled on a common shaft in cartridge-type, hermetically sealed unit, without stuffing boxes or mechanical seals. Include isolation of motor section from motor-stator windings by corrosion-resistant, nonmagnetic, alloy liner. Include design rated for 125-psig minimum working pressure and a continuous water temperature of 225 deg F.

1. Casing: Cast bronze or cast iron, with stainless-steel liner, static O-ring seal to separate motor section from motor stator, and flanged piping connections.
2. Impeller: Overhung, single suction, closed or open, nonmetallic.
3. Shaft and Sleeve: Stainless-steel shaft with carbon-steel sleeve.
4. Motor: Single speed.
5. Motor: Multispeed.

V. Vertical In-line Pumps

A. Description: Vertical, in-line, centrifugal, flexible-coupled, single-stage, radially split case design. Include vertical-mounting, bronze-fitted design and mechanical seals rated for 125-psig minimum working pressure and a continuous water temperature of 225 deg F.

1. Casing: Cast iron, with threaded companion flanges for piping connections smaller than 3” NPS, drain plug at low point of volute, and threaded gage tappings at inlet and outlet connections.
2. Impeller: ASTM B 584, cast bronze, statically and dynamically balanced, closed, overhung, single suction, and keyed to shaft.
3. Wear Rings: Replaceable, bronze casing ring.
4. Shaft and Sleeve: Ground and polished stainless-steel shaft with bronze sleeve.
5. Shaft: Ground and polished stainless-steel shaft with axially split spacer coupling.
6. Seals: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and flexible bellows and gasket.
7. Motor: Directly mounted to pump casing and with lifting and supporting lugs in top of motor enclosure.

VI. Flexible-coupled, End-suction Pumps

A. Description: Base-mounted, centrifugal, flexible-coupled, end-suction, single-stage, bronze-fitted, back-pull-out, radially split case design; rated for 175-psig minimum working pressure and a continuous water temperature of 225 deg F.

1. Casing: Cast iron, with flanged piping connections, drain plug at low point of volute, threaded gage tappings at inlet and outlet connections, and integral feet or other means on volute to support weight of casing and attached piping. Casing shall allow removal and replacement of impeller without disconnecting piping.
2. Impeller: ASTM B 584, cast bronze, statically and dynamically balanced, closed, overhung, single suction, keyed to shaft, and secured by locking cap screw.
3. Wear Rings: Replaceable, bronze casing ring.
4. Shaft and Sleeve: Steel shaft with bronze sleeve.
5. Seals: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and flexible bellows and gasket.
6. Coupling: Flexible-spacer type, capable of absorbing torsional vibration and shaft misalignment; with flange and sleeve section that can be disassembled and removed without removing pump or motor.
7. Coupling Guard: Steel, removable, and attached to mounting frame.
8. Mounting Frame: Welded-steel frame and cross members, factory fabricated from ASTM A 36/A 36M channels and angles. Fabricate for mounting pump casing, coupling guard, and motor. Field-drill motor-mounting holes for field-installed motors.
   a) Option: Cast-iron frames are acceptable.
9. Motor: Secured to mounting frame, with adjustable alignment.

VII. Pump Specialty Fittings

A. Suction Diffuser: Angle or straight pattern, 175-psig or as required for system, pressure rating, cast-iron body and end cap, pump-inlet fitting; with bronze startup and bronze or stainless-steel permanent strainers; bronze or stainless-steel straightening vanes; drain plug; and factory- or field-fabricated support.

Part 3 - Execution

I. Examination

A. Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation.

1. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.

2. Examine foundations and inertia bases for suitable conditions where pumps are to be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

II. Pump Installation

A. Install pumps according to manufacturer's written instructions.

1. Install pumps according to HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation."

B. Install pumps to provide access for periodic maintenance, including removing motors, impellers, couplings, and accessories.

C. Support pumps and piping separately so piping is not supported by pumps.

D. Suspend in-line pumps using continuous-thread hanger rod and vibration-isolation hangers. Install seismic bracing as required by authorities having jurisdiction.

E. Set base-mounted pumps on concrete foundation. Disconnect coupling halves before setting. Do not reconnect couplings until alignment operations have been completed.

1. Support pump baseplate on rectangular metal blocks and shims, or on metal wedges with small taper, at points near foundation bolts to provide a gap of 3/4 to 1-1/2 inches between pump base and foundation for grouting.

2. Adjust metal supports or wedges until pump and driver shafts are level. Check coupling faces and suction and discharge flanges of pump to verify that they are level and plumb.

III. Alignment

A. Align pump and motor shafts and piping connections after setting them on foundations, after grout has been set and foundation bolts have been tightened, and after piping connections have been made.

B. Comply with pump and coupling manufacturers' written instructions.

C. Adjust pump and motor shafts for angular and offset alignment by methods specified in HI 1.1-1.5, "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation."

D. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with non-shrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

IV. Connections

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Connect piping to pumps. Install valves that are the same size as piping connected to pumps.

D. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.

E. Install check valve and throttling valve on discharge side of in-line circulators.

F. Install non-slam check valve and globe valve on discharge side of vertical in-line pumps.

G. Install suction diffuser and shutoff valve on suction side of vertical in-line pumps.

H. Install suction diffuser and shutoff valve on suction side of base-mounted pumps.

I. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves.

J. Install pressure gages on pump suction and discharge. Install at integral pressure-gage tappings where provided.

K. Install temperature and pressure-gage connector plugs in suction and discharge piping around each pump.

L. Install electrical connections for power, controls, and devices.

M. Electrical power and control wiring and connections are specified in Division 16 Sections.

N. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

V. Commissioning

A. Verify that pumps are installed and connected according to the Contract Documents.

B. Verify that electrical wiring installation complies with manufacturer's written instructions and the Contract Documents.

C. Perform the following preventive maintenance operations and checks before starting:

1. Lubricate bearings.
2. Remove grease-lubricated bearing covers, flush bearings with kerosene, and clean thoroughly. Fill with new lubricant according to manufacturer's written instructions.
3. Disconnect coupling and check motor for proper rotation that matches direction marked on pump casing.
4. Verify that pumps are free to rotate by hand and that pumps for handling hot liquids are free to rotate with pumps hot and cold. Do not operate pumps if they are bound or drag, until cause of trouble is determined and corrected.
5. Check suction piping connections for tightness to avoid drawing air into pumps.

6. Clean strainers.
7. Verify that pump controls are correct for required application.

D. Starting procedure for pumps with shutoff power not exceeding safe motor power is as follows:
   1. Prime pumps by opening suction valves and closing drains, and prepare pumps for operation.
   2. Open cooling water-supply valves in cooling water supply to bearings, where applicable.
   3. Open cooling water-supply valves if stuffing boxes are water cooled.
   4. Open sealing liquid-supply valves if pumps are so fitted.
   5. Open warm-up valves of pumps handling hot liquids if pumps are not normally kept at operating temperature.
   6. Open circulating line valves if pumps should not be operated against dead shutoff.
   7. Start motors.
   8. Open discharge valves slowly.
   9. Observe leakage from stuffing boxes and adjust sealing liquid valve for proper flow to ensure lubrication of packing. Let packing "run in" before reducing leakage through stuffing boxes; then tighten glands.
   10. Check general mechanical operation of pumps and motors.
   11. Close circulating line valves once there is sufficient flow through pumps to prevent overheating.

E. When pumps are to be started against closed check valves with discharge shutoff valves open, steps are the same, except open discharge valves before starting motors.

F. Refer to Division 15 Section "Testing, Adjusting, and Balancing" for detailed requirements for testing, adjusting, and balancing hydronic systems.

END OF SECTION

Part 1 - General

I. Related Documents
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

II. Summary

III. This Section includes steam and condensate piping and specialties for systems up to 125 psig, inside the building.

IV. Related Sections include the following:
   A. Division 23 Section "Basic Mechanical Materials and Methods" for general piping materials and installation requirements.
   B. Division 23 Section "Hangers and Supports" for pipe supports, product descriptions, and installation requirements. Hanger and support spacing is specified in this Section.
   C. Division 23 Section "Valves" for general-duty gate, globe, ball, butterfly, and check valves.
   D. Division 23 Section "Meters and Gages" for thermometers, flow meters, and pressure and vacuum gages.
   E. Division 23 Section "Mechanical Identification" for labeling and identifying steam and condensate piping.
   F. Division 23 Section "Feedwater Equipment."
   G. Division 23 Section "HVAC Instrumentation and Controls" for temperature-control valves and sensors.

V. Definitions
   A. HP Systems: High-pressure systems operating at 15 psig or more.
   B. LP Systems: Low-pressure systems operating at less than 15 psig.

VI. System Description
   A. Steam and condensate piping for this Project is a two-pipe, mechanical flow, upfeed system.

VII. Submittals
   A. Product Data: For each type of special-duty valve and steam trap indicated, including rated capacities and accessories.
   B. Welding Certificates: Copies of certificates for welding procedures and personnel.
   C. Field Test Reports: Written reports of tests specified in Part 3 of this Section. Include the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Failed test results and corrective action taken to achieve requirements.

D. Maintenance Data: For steam traps, vacuum breakers, and meters to include in maintenance manuals specified in Division 1.

VIII. Quality Assurance

A. Welding: Qualify processes and operators according to the ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp flash tanks to comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

IX. Coordination

A. Coordinate layout and installation of steam and condensate piping and suspension system components with other construction, including light fixtures, hydronic piping, fire-suppression-system components, and partition assemblies.

B. Coordinate piping installation with roof curbs, equipment supports, and roof penetrations.

C. Coordinate pipe fitting pressure classes with products specified in related Sections.

Part 2 - Products

I. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

A. Safety Valves:

1. Armstrong International, Inc.
2. Kunkle Inds. Inc.; Kunkle Valve Division.
3. Spirax Sarco, Inc.
4. Watts Industries, Inc.; Watts Regulators.

B. Pressure-Reducing Valves:

1. Armstrong International, Inc.
2. ITT Hoffman; ITT Fluid Technology Corp.
3. Leslie Controls, Inc.
4. Spence Engineering Company, Inc.
5. Spirax Sarco, Inc.

C. Steam Traps:

1. Armstrong International, Inc.
2. Dunham-Bush, Inc.
3. ITT Hoffman; ITT Fluid Technology Corp.
4. Spirax Sarco, Inc.
5. Sterling, Inc.

D. Air Vents and Vacuum Breakers:
1. Armstrong International, Inc.
2. ITT Hoffman; ITT Fluid Technology Corp.
3. Johnson Corp. (The).
4. Spirax Sarco, Inc.

E. Steam Meters:
1. EMCO Flowmeters.
2. ISTEC Corp.
3. Preso Meters Corp.
4. Spirax Sarco, Inc.

F. Condensate Meters:
1. Hersey Measurement Company.
2. ISTEC Corp.

II. Piping Materials

A. General: Refer to Part 3 piping application articles for applications of pipe and fitting materials.

III. Steel Pipe And Fittings

A. Steel Pipe, 2” NPS and Smaller: ASTM A 53, Type S (seamless), Grade A, Schedules 40 and 80, black steel, plain ends.

B. Steel Pipe, 2-1/2” NPS through 12” NPS: ASTM A 53, Type E (electric-resistance welded), Grade A, Schedules 40 and 80, black steel, plain ends.

C. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125, 150, and 300.

D. Malleable-Iron Threaded Fittings: ASME B16.3; Classes 150 and 300.

E. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300.

F. Cast-Iron Threaded Flanges and Flanged Fittings: ASME B16.1, Classes 125 and 250; raised ground face, and bolt holes spot faced.

G. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.

H. Wrought-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
1. Material Group: 1.1.

2. End Connections: Butt welding.
3. Facings: Raised face.

I. Flexible Connectors: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket; 150-psig minimum working pressure and 250 deg F maximum operating temperature. Connectors shall have flanged or threaded-end connections to match equipment connected and shall be capable of 3/4-inch misalignment.

J. Welding Materials: Comply with Section II, Part C, of the ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.

K. Gasket Material: Thickness, material, and type suitable for fluid to be handled; and design temperatures and pressures.

IV. Valves

A. Gate, globe, check, ball, butterfly, outside stem and yoke valves are specified in Division 15 Section "Valves."

B. Refer to Part 3 "Valve Applications" Article for applications of each valve.

V. Safety Valves

A. Size and Capacity: As required for equipment according to the ASME Boiler and Pressure Vessel Code.

B. Brass or Bronze Safety Valves: Class 250, with threaded inlet and outlet; forged copper-alloy disc; fully enclosed steel spring with adjustable pressure range and positive shutoff; factory set and sealed.

1. Drip-Pan Elbow: Cast iron and having threaded inlet and outlet with threads complying with ASME B1.20.1.

C. Cast-Iron Safety Valves: Class 250; forged copper-alloy disc with bronze nozzle; fully enclosed, cadmium-plated steel spring with adjustable pressure range and positive shutoff; raised-face flanged inlet and threaded outlet connections; factory set and sealed.

1. Drip-Pan Elbow: Cast iron and having threaded inlet and outlet with threads complying with ASME B1.20.1.

D. Stop-Check Valves: Class 250, malleable-iron body and bonnet, cylindrical disc, removable liner and machined seat, brass-alloy stem, outside screw and yoke, polytetrafluoroethylene-impregnated packing with 2-piece packing gland assembly, flanged end connections, and cast-iron handwheel.

VI. Steam Traps

A. Float and Thermostatic Traps: ASTM A 126, cast-iron body and bolted cap; renewable, stainless-steel float mechanism with renewable, hardened stainless-steel head and seat; maximum operating pressure of 125 psig; balanced-pressure, stainless-steel or monel thermostatic bellow element.

1. Thermostatic air vent capable of withstanding 45 deg F of superheat and resisting water hammer without sustaining damage.

VII. Thermostatic Air Vents

A. Quick Vents: Cast-iron or brass body, with balanced-pressure, stainless-steel or monel thermostatic bellows and stainless-steel heads and seats.

B. Float Vents: Cast-iron or brass body, seamless brass float, balanced-pressure thermostatic bellows, and replaceable stainless-steel seat, float, and head.

VIII. Vacuum Breakers

A. Vacuum Breakers: 150-psig steam working pressure, 365 deg F maximum operating temperature, brass or stainless-steel body, and stainless-steel retainer, spring, and ball; with plain or threaded outlet.

IX. Strainers

A. Y-Pattern Strainers: 250-psig working steam pressure; ASTM A 126, Class B cast-iron body; stainless-steel screen, No. 20 mesh for 2” NPS and smaller and manufacturer's recommended perforations for 2-1/2” NPS and larger; tapped blowoff plug. Threaded connections for strainers 2” NPS and smaller and flanged connections for strainers 2-1/2” NPS and larger.

B. Basket Strainers: 250-psig working steam pressure; ASTM A 126, Class B cast-iron body; stainless-steel screen; bolted cover; threaded connections for strainers 2” NPS and smaller and flanged connections for strainers 2-1/2” NPS and larger.

Part 3 - Execution

I. Low Pressure Steam Piping Applications

A. Steam Piping, 2” NPS and Smaller: Schedule 40 steel pipe, with threaded joints using Class 125 cast-iron fittings.

B. Steam Piping, 2-1/2” NPS through 12” NPS: Schedule 40 steel pipe, with welded joints using Schedule 40 wrought-steel welding fittings and Class 150 wrought-steel flanges.

C. Condensate Piping, 2” NPS and Smaller: Schedule 80 steel pipe, with threaded joints using Class 125 malleable-iron fittings.

D. Condensate Piping, 2-1/2” NPS through 12” NPS: Schedule 80 steel pipe, with welded joints using Schedule 80 wrought-steel welding fittings and Class 150 wrought-steel flanges.

II. Low Pressure Steam-trap Applications

A. Float and Thermostatic Traps: Steam main and riser drip legs, laundry equipment, kitchen equipment, heat exchangers, and heating coils.

III. Piping Installations

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation requirements.

B. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

C. Install drains, consisting of a tee fitting, ¾” NPS ball valve, and short ¾” NPS threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

D. Install steam supply piping at a uniform grade of 0.2 percent downward in direction of steam flow.

E. Install condensate return piping at a uniform grade of 0.4 percent downward in direction of condensate flow.

F. Reduce pipe sizes using eccentric reducer fitting installed with level side down.

G. Unless otherwise indicated, install branch connections to steam mains using 45-degree fittings in main pipe, with the takeoff coming out the top of the main pipe. Use of 90-degree tee fittings is permissible if 45-degree fittings are impractical. If length of branch takeoff is less than 10 feet, pitch branch line down toward mains at a 0.4 percent grade.

H. Install unions in piping 2” NPS and smaller adjacent to each valve, at final connections of each piece of equipment, and elsewhere as indicated.

I. Install flanges in piping 2-1/2” NPS and larger at final connections of each piece of equipment and elsewhere as indicated.

J. Install strainers on supply side of each control valve, pressure-reducing valve, solenoid valve, traps, and elsewhere as indicated. Install ¾” NPS nipple and ball valve in blowdown connection of strainers 2” NPS and larger. Match size of strainer blowoff connection for strainers smaller than 2” NPS.

K. Anchor piping for proper direction of expansion and contraction.

L. Install drip legs at low points and natural drainage points such as ends of mains, bottoms of risers, and ahead of pressure regulators, control valves, isolation valves, pipe bends, and expansion joints.

1. On straight runs with no natural drainage points, install drip legs at intervals not exceeding 300 feet where pipe is pitched down in direction of steam flow and a maximum of 150 feet where pipe is pitched up in direction of steam flow.
2. Size drip legs at vertical risers same size as pipe and extend beyond rise. Size drip legs at other locations same diameter as main. In steam mains 6" NPS and larger, dirt leg size can be reduced, but to no less than 4" NPS.
3. Install gate valve at drip legs, dirt pockets, and strainer blowdowns to allow removal of dirt and scale.
4. Install steam traps close to drip legs.

M. Pitch condensate piping down toward flash tank. If more than one condensate pipe discharges into flash tank, install a swing check valve in each line. Install thermostatic air vent at top of tank. Install inverted bucket or float and thermostatic trap at low-pressure condensate outlet, sized for three times the condensate load. Install safety valve at tank top. Install pressure gage, gate valve, and swing check valve on low-pressure (flash) steam outlet.

IV. Steam-trap Installation

A. Install steam traps in accessible locations as close as possible to connected equipment, but not more than 48 inches from connected equipment.
   1. Unless otherwise indicated, install gate valve, strainer, and union upstream from trap; install union, check valve, and gate valve downstream from trap.

V. Safety Valve Installations

A. Install safety valves according to ASME B31.1. Pipe safety valve discharge without valves to atmosphere outside building. Install drip-pan elbow fitting adjacent to safety valve and pipe drain connection to nearest floor drain.

VI. Hangers And Supports

A. Hanger, support, and anchor devices are specified in Division 15 Section "Hangers and Supports."

B. Install the following pipe attachments:
   1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
   2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
   3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
   4. Spring hangers to support vertical runs.

C. Install hangers with the following maximum spacing and minimum rod sizes:

1. 3/4” NPS: Maximum span, 9 feet; minimum rod size, 1/4 inch.
2. 1” NPS: Maximum span, 9 feet; minimum rod size, 1/4 inch.
3. 1-1/2” NPS: Maximum span, 12 feet; minimum rod size, 3/8 inch.
4. 2” NPS: Maximum span, 13 feet; minimum rod size, 3/8 inch.
5. 2-1/2” NPS: Maximum span, 14 feet; minimum rod size, 3/8 inch.
6. 3” NPS: Maximum span, 15 feet; minimum rod size, 3/8 inch.
7. 4” NPS: Maximum span, 17 feet; minimum rod size, 1/2 inch.
8. 6” NPS: Maximum span, 21 feet; minimum rod size, 1/2 inch.
9. 8” NPS: Maximum span, 24 feet; minimum rod size, 5/8 inch.
10. 10” NPS: Maximum span, 26 feet; minimum rod size, 3/4 inch.

D. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

VII. Pipe Joint Construction

A. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for joint construction requirements for threaded, welded, and flanged joints.

VIII. Terminal Equipment Connections

A. Size for supply and return piping connections shall be same as for equipment connections.

B. Install traps and control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If multiple, parallel control valves are installed, only one bypass is required.

D. Install vacuum breaker downstream from control valve and bypass and close to coil inlet connection.

E. Install ports for pressure and temperature gages at coil inlet connections.

F. Install a drip leg at coil outlet.

IX. Field Quality Control

A. Prepare steam and condensate piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Flush system with clean water. Clean strainers.
3. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
4. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on steam and condensate piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release trapped air. Use drip legs installed at low points for complete draining of liquid.
3. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the design pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed either 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A of ASME B31.9, "Building Services Piping."
4. After hydrostatic test pressure has been applied for at least 30 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
5. Prepare written report of testing.

X. Adjusting

A. Mark calibrated nameplates of pump discharge valves after steam and condensate system balancing has been completed, to permanently indicate final balanced position.

B. Perform these adjustments before operating the system:

1. Open valves to fully open position. Close coil bypass valves.
2. Set temperature controls so all coils are calling for full flow.
3. Check operation of automatic bypass valves.

XI. Cleaning

A. Flush steam and condensate piping with clean water. Remove and clean or replace strainer screens.

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 -General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope
   A. This section includes refrigerant liquid, hot gas and suction piping system, including pipe, fittings, valves, specialty items and refrigerant.
   B. The refrigeration piping system shall be provided, installed, tested, evacuated and charged.

III. Quality Assurance
   A. The refrigeration piping system shall be provided, installed, tested, evacuated and charged in accordance with the manufacturer's recommendations, ANSI, ASHRAE, and ARI's Safety Code for Mechanical Refrigeration, state and local codes.
   B. Charging reports and field test reports shall be provided to PGCPS at the conclusion of installation.
   C. Referenced Codes and Standards: Comply with the following in accordance with Division 1.
      1. American National Standards Institute/American Society of Heating, Refrigerating and Air-Conditioning Engineers (ANSI/ASHRAE)
         a) ASHRAE Standard 15 - Safety Standards for Refrigeration Systems
         b) ASHRAE Standard 34 - Designation and Safety Classification of Refrigerants
      2. American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
         a) ASME B31.5 - Refrigeration Piping and Heat Transfer Components
      3. Air-Conditioning, Heating and Refrigeration Institute (AHRI)
         a) AHRI Standard 700 - Specifications for Fluorocarbons and Other Refrigerants
      4. U.S. Department of Labor, Occupational Safety and Health Administration (OSHA)
         a) OSHA Standard 1910 - Occupational Safety and Health Standards
      5. U.S. Environmental Protection Agency (EPA)
         a) Clean Air Act Ammendments of 1990

IV. Submittals
   A. Provide shop drawings on the proposed system as described in Section 230100.

Part 2 - Products

I. General

A. The refrigerant piping system shall be provided complete and installed in accordance with the manufacturer's recommendations and as specified herein. The size of the refrigerant pipes shall be obtained from the equipment manufacturer unless otherwise shown on the drawings.

B. Pipe, Fittings and Accessories - The pipe shall be type ACR 'L' copper refrigerant tubing with hard wrought copper fittings. Pipe sized ½ inch and larger shall be hard drawn. Pipe size 3/8 inch and smaller can either be hard or soft drawn. All of the joints shall be brazed with a filler material that complies with AWS classification BCuP-5. A sight glass with moisture indicator shall be provided if not provided with equipment (not required on VRF systems). A removable type SPORLAN cartridge type drier-strainer shall be installed in the liquid line with a three-way valve by-pass if it is not provided on the equipment (not required on VRF systems). Use type 'L' copper tubing to pipe the relief valve discharge to the outside.

C. Condensate Drain Piping - Shall be type 'L' or type ‘M’ copper tubing.

D. Pipe Hangers and Supports - Shall be as required in section 230500.

E. The piping shall be insulated as shown in section 230700.

F. Specialties

1. Filter Dryers: Replaceable core, low pressure drop, capable of removing acids, corrosion-resistant steel shell, wrought copper fittings, UL listed. Series V-8000 as manufactured by Henry Technologies or equivalent by Sporlan or Ranco.
2. Liquid Indicators: By color change, factory assembled, with polished optical glass, triple sealed, removable cap, flared or soldered connections, soldered connections with extended ends, UL listed. Dri-Vue as manufactured by Henry Technologies or equivalent by Sporlan or Alco.
3. Strainers: With replaceable No. 10 mesh brass screen cartridge held in place by spring tension, UL listed. Type 866 or 895 as manufactured by Henry Technologies or equivalent by Sporlan or Mueller Brass.

Part 3 - Execution

I. General

A. The Refrigeration Piping System shall be installed in accordance with the manufacturer's recommendations and requirements of referenced ANSI, AHRI, ASHRAE and OSHA codes and standards as specified herein.

B. Installation - During brazing, dry nitrogen shall be continuously passed through the system at a rate sufficient to maintain an oxygen free environment to prevent the formation of copper oxide scale. After piping has been completed, the refrigerant piping system shall be pressure tested at a pressure of 300 psi on the high side and 150 psi on the low side. The pressure shall be maintained on the system for a minimum of 24 hours. The system shall be evacuated when the surrounding ambient air is not less than 60°F. If the temperature is less, auxiliary heat must be provided to insure proper evacuating conditions. A minimum vacuum of 500 Microns of Hg. shall be pulled on the system and maintained for 24 hours. The vacuum pump displacement shall be not less than 2 cfm for up to 15 tons.

C. The system shall be charged as recommended by the equipment manufacturer.

D. Insulation

1. Insulate hot gas piping if the piping surface temperature exceeds 120 degrees F.
2. Insulate suction piping from DX coil to condensing unit to prevent dripping.
3. Insulate piping in accordance with Section 230700.

END OF SECTION

Refrigerant Monitoring and Safety Equipment
Section 232316

Part 1 - General

I. Summary
   A. This Section includes refrigerant monitors, alarms, and breathing apparatus.

II. Definitions
   A. CMOS: Ceramic metal-oxide semiconductor.
   B. HFC: Hydrofluorocarbon.
   C. HCFC: Hydrochlorofluorocarbon.
   D. IR: Infrared.
   E. SCBA: Self-contained breathing apparatus.

III. Submittals
   A. Product Data: For SCBA; include mounting details and service requirements and compliance with authorized Federal agency.
   B. Shop Drawings: For each type of refrigerant monitor; include refrigerant ppm range, temperature range, alarm outputs, readout range, furnished specialities, installation requirements, and power consumption.
      1. Wiring Diagrams: Power, signal, and control wiring.
   C. Operation and maintenance data.

IV. Quality Assurance
   A. ASHRAE: Monitoring system shall comply with ASHRAE 15.
   B. CFR: SCBA shall comply with requirements in 42 CFR 84.

Part 2 - Products

I. Manufacturers
   A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
      1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

II. Functional Description Of Refrigerant Monitoring System
   A. On leak detection by refrigerant sensor(s), the system shall perform the following:
      1. Activate machinery room ventilation.
      2. Activate audio and visual alarm inside and outside machinery room.

3. Shut down combustion process where combustion equipment is employed.
4. Notify Building Automation System of alarm condition.

III. Refrigerant Monitor

A. Approved Manufacturers:
1. Davis Instruments Manufacturing Co., Inc.
2. Foxboro Company (The).
3. General Analysis Corp.
4. Genesis International Inc.
5. Thermal Gas Systems, Inc.; Haloguard Monitors.
6. Trane Co. (The).
7. Approved Equal.

B. Description: CMOS or IR sensor shall continuously measure and display the specific gas concentration and shall be capable of indicating, alarming, and shutting down equipment, and automatically activating ventilation system.

C. Performance Requirements:
1. Refrigerant(s) to be Monitored: Selected refrigerant(s) for chiller(s).
2. Refrigerant Concentration: Per ASHRAE 15 requirement for specific refrigerant.
3. Accuracy: 0 to 100 ppm; 1 ppm; 100 to 1000 ppm; plus or minus 10 percent of reading.
4. Linearity: 0 to 100 ppm; linear; 100 to 1000 ppm; plus or minus 2 percent of full scale.
5. Sensitivity: 1 ppm.
6. Resolution: 1 ppm.
7. Operating Temperature: 41 to 104 deg F.
8. Response Time: 90 percent of a step change in 4 minutes.
9. Relatively Humidity: 20 to 95 percent, non-condensing over the operating temperature range.

D. Operating Requirements:
1. Maximum Power Input: 120-V ac; 60 Hz, 30 W.
2. Alarm Relays: 3 relays at 5- to 8-A resistive load.
3. Alarm Set Points: Displayed on front of meter.
4. Audible Output: Sonic alert at 75 to 80 dB at 60 inches (1525 mm).
5. Analog Output: 0- to 10-V dc or 4- to 20-mA current sourcing.
6. Serial Output Type: RS 232.

E. Sensor Configuration: CMOS sensor.
1. Single-sensing channel.

2. Expandable to four or greater as scheduled on the drawings channels.

F. Display: 10-character, alphanumeric, vacuum-fluorescent indicating lights for each alarm set point; standard alarm; acknowledge switch and test switch mounted on front panel; and alarm status LEDs and service fault LEDs.

1. Enclosure: NEMA 250, type as required for ambient condition.

G. Alarm Output: Indicating light flashes and horn sounds.

1. Unit-mounting device with single-light beacon.
2. Remote unit for mounting outside machinery room and having light beacon with quantities of lights shown on the drawings.
3. Field-adjustable alarm set points.

H. Calibration: Factory calibrated.

I. SCBA

J. Manufacturers:

1. AFC International, Inc.
2. Clarey's Safety Equipment, Inc.
3. Genesis International Inc.
4. MSA, Instrument Division.
5. Thermal Gas Systems, Inc.; Haloguard Monitors.

K. Description: Open-circuit, pressure-demand, compressed-air SCBA includes completely assembled, portable, self-contained devices designed for hazardous breathing environment application.

L. Face Piece: EPDM construction material, one-size-fits-all with double-sealing edge, stainless-steel speaking diaphragm and lens retainer, five adjustable straps to hold face piece to head (two straps on each side and one on top), exhalation valve in mask, close-fitting nose piece to ensure no CO_2 build-up, and perspiration drain to avoid skin irritation and to prevent eyepiece, spectacle, and lens fogging.

M. Backplate: Orthopedically designed of high-strength chemical and impact-resistant glass-fiber composite or lightweight aluminum.

N. Harness and Carrier Assembly: Large triangular back pad, backplate, and adjustable waist and shoulders straps. Modular in design, detachable components, and easy to clean and maintain. Shoulder straps are padded with flame-resistant material and reinforced with stainless-steel cable and attached with T-nuts, washers, and screws; rivets are not permitted.

O. Air Cylinder: 30-minute, low-pressure, air-supply-loaded fiberglass cylinders fitted with quick-fill assembly for refilling and air transfer.

P. Wall-Mounted Case: Leakproof, corrosion-resistant, tough, plastic case.

IV. Control Cable

A. Electronic and fiber-optic cable for control wiring shall be as specified in Division 16.

V. Source Quality Control

A. SCBA: Tested and certified by the National Institute for Occupational Safety and Health and the Mine Safety and Health Administration according to 42 CFR 84, Subpart H.

B. Refrigerant Monitor: Factory tested and certified.

Part 3 - Execution

I. Installation

A. Install labels and nameplates to identify monitoring devices and SCBA components according to Division 15 Section Basic Mechanical Materials and Methods or Mechanical Identification.

B. Install building wire and cable according to Division 16 Section "Conductors and Cables".

C. Install signal and communication cable according to Division 16 Section “Voice and Data Communication Cabling."

II. Field Quality Control

A. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:

1. Inspect field-assembled components, equipment installation, and electrical connections for compliance with requirements.
2. Test and adjust controls and safeties.
3. Test Reports: Prepare a written report to record the following:
   a) Test procedures used.
   b) Test results that comply with requirements.
   c) Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

B. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

III. Adjusting

A. Adjust alarm set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION

Part 1 - General

I. Related Documents
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

II. Summary
   A. This Section includes water-treatment systems for the following:
      1. Heating, hot-water piping (closed-loop system).
      2. Chilled-water piping (closed-loop system).
      3. Heating, steam and condensate piping.
      4. Steam and condensate piping for humidifiers and cooking appliances (open systems).
      5. Condenser water piping (open system).

III. Chemical Feed System Description
   A. Closed-Loop System: One bypass feeder on each system with isolating and drain valves downstream from circulating pumps, unless otherwise indicated.
      1. Introduce chemical treatment through bypass feeder when required or indicated by test.
   B. Closed-Loop, Heating Steam and Condensate Piping: Lead-lag switch controls the sequence of boilers and introduces the chemical to the boiler through a bypass feeder.
   C. Chemical feed pump introduces sequestering agent and base from solution tank into condensate tank or return water line close to each boiler as required, with minimum of one pump per boiler. Use agitator as required.
   D. Pump oxygen scavenger feed from solution tank into feedwater line as far as possible from boiler. Use agitator as required.
   E. Feed carbon dioxide, neutralizing amine from solution tank directly into condensate tank. Use agitator as required.
   F. Activate chemical solution pump when feedwater pumps are running.
      1. Activate chemical solution pump from meter on makeup water line only when one boiler is used.
      2. Continuously run pump for feeding chemical when multiple boilers are used.
      3. Liquid-level switch, in each solution tank, deactivates chemical solution pump and signals alarm.
      4. Conductivity controller samples boiler water on timed cycle and operates solenoid blowdown valve.

G. Open-Loop Systems for Humidifiers, Air Washers, Evaporative Condensers, and Cooling Towers: PVC tubing with hole to feed chemical.
   1. Conductivity controller samples sump water when activated by pump and operates solenoid bleed-off valve in line to drain.

H. Open-Loop, Condenser Water Piping: Pump sequestering agent and corrosion inhibitor from solution tank into condenser water supply to tower. Use agitator as required.
   1. Intermittently feed biocide to condenser water to achieve a toxic level of the chemical to kill the organism present.
   2. Change biocides periodically to avoid chemical immunity.
   3. Activate chemical solution pump from water meter in makeup water line to cooling tower when condenser water pumps are running.
   4. Automatically feed chemical with electronic solid-state controllers.
   5. Deactivate solution pump and signal alarm by a liquid-level switch in each solution tank on low chemicals.

IV. Performance Requirements

A. Maintain water quality for HVAC systems that controls corrosion and build-up of scale and biological growth for maximum efficiency of installed equipment without posing a hazard to operating personnel or the environment.

B. Base chemical treatment performance requirements on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.

V. Submittals

A. Product Data: Include rated capacities; water-pressure drops; shipping, installed, and operating weights; and furnished products listed below:

B. Pumps.
   1. Chemical solution tanks.
   2. Agitators.
   3. Control equipment and devices.
   4. Test equipment.
   5. Chemicals.
   6. Filters.
   7. Chemical feeders.

C. Shop Drawings: Detail equipment assemblies indicating dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   1. Wiring Diagrams: Detail power and control wiring and differentiate between manufacturer-installed and field-installed wiring.

D. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

E. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

F. Maintenance Data: For pumps, agitators, filters, system controls, and accessories to include in maintenance manuals specified in Division 1.

VI. Quality Assurance

A. Installer Qualifications: An experienced installer who is an authorized representative of the chemical treatment manufacturer for both installation and maintenance of chemical treatment equipment required for this Project.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

VII. Maintenance

A. Scope of Service: Provide chemicals and service program for maintaining optimum conditions in the circulating water for inhibiting corrosion, scale, and organic growths in the applicable piping systems and equipment. Services and chemicals shall be provided for a period of one year from date of Substantial Completion, including the following:
   1. Initial water analysis and recommendations.
   2. Startup assistance.
   3. Periodic field service and consultation.
   4. Customer report charts and log sheets.
   5. Laboratory technical assistance.
   6. Analyses and reports of all chemical items concerning safety and compliance with government regulations.

VIII. Extra Materials

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

Part 2 - Products

I. Manufacturers
   A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1. HVAC Water-Treatment Products:
         a) Aqua-Chem, Inc.; Cleaver-Brooks Div.
         b) Calgon Corp., ECC International.
         c) Trane Boland Services; Water Treatment.

II. Chemical Feeding Equipment
   A. Bypass Feeders: Cast iron or steel, for introducing chemicals into system; with funnel shutoff valve on top, air-release valve on top, drain valve on bottom, and recirculating shutoff valves on sides.
      1. Capacity: 2 quarts (low capacity systems) or 5 gal. (high capacity systems).
      2. Working Pressure: 125 psig.
   B. Drip Feeders: Plastic reservoir with capillary tubing probe, weight, charging syringe, and clip.
   C. Positive-Displacement Diaphragm Pump: Simplex, self-priming, rated for intended chemical with 25 percent safety factor for design pressure and temperature.
      1. Adjustable flow rate.
      2. Thermoplastic construction.
      3. Fully enclosed, continuous-duty, 120-V, 60-Hz, single-phase motor. Comply with requirements in Division 15 Section "Motors."
      4. Built-in relief valve.
   D. Positive-Displacement Piston Pump: Metal and thermoplastic construction.
      1. Fully enclosed, continuous-duty, 120-V, 60-Hz, single-phase motor. Comply with requirements in Division 15 Section "Motors."
      2. Built-in relief valve.
   E. Chemical Solution Tanks: Chemical-resistant reservoirs fabricated from high-density opaque polyethylene with graduated markings.
      1. Molded fiberglass cover with recess for mounting pump, agitator, and liquid-level switch.
      2. Capacity: 30 gal. (low capacity systems) or 50 gal. (high capacity systems.

F. Agitator: Direct drive, 1750 rpm, mounted on tank with angle adjustment.
   1. Fully enclosed, continuous-duty, 120-V, 60-Hz, single-phase motor. Comply with requirements in Division 15 Section "Motors."
   2. Stainless-steel clamp and motor mount, with stainless-steel shaft and propeller.

G. Liquid-Level Switch: Polypropylene housing, integrally mounted PVC air trap, receptacles for connection to metering pump, and low-level alarm.

H. Packaged Conductivity Controller: Solid-state circuitry, 5 percent accuracy, linear dial adjustment, built-in calibration switch, on-off switch and light, control-function light, output to control circuit, and recorder.

I. Cold-Water Meter: Positive-displacement type with sealed, tamperproof magnetic drive; impulse contact register; single-pole, double-throw, dry-contact switch.
   1. Rotating-disc or Turbine type with bronze or cast-iron body rated for 125 psig.
   2. Magnetic-drive or mechanical-impulse contactor matched to signal receiver.
   3. At least six-digit totalizers.
   4. 120-V ac.

J. Solenoid Valves: Forged-brass body, globe pattern, and general-purpose solenoid enclosure with 120-V, continuous-duty coil.

K. Electronic Timers: 150-second and 5-minute ranges, with infinite adjustment over full range, and mounted in cabinet with hand-off-auto switches and status lights.

L. Chemical Tubing: Schedule 40, PVC with solvent-cement joints; or polypropylene tubing with heat fusion.

M. Plastic Ball Valves: Rigid PVC or CPVC body, integral union ends, and polytetrafluoroethylene seats and seals.

N. Plastic-Body Strainer: Rigid PVC or CPVC with cleanable stainless-steel strainer element.

O. Condenser Water-Treatment Control Panel: Incorporate solid-state integrated circuits and digital LED displays, in NEMA 250, Type 12 enclosure with gasketed and lockable door.
   1. Control dissolved solids, based on conductivity, and include the following:
      a) Digital readout display.
      b) Temperature-compensated sensor probe adaptable to sample stream manifold.
      c) High, low, and normal conductance indicator lights.
      d) High or low conductance alarm light, trip points field adjustable; with silence switch.
      e) Hand-off-auto switch for solenoid bleed-off valve.
      f) Bleed-off light to indicate valve operation.
      g) Internal adjustable hysteresis or dead band.

2. Control inhibitor feeding, based on makeup volume, and include the following:
   a) Solid-state reset counter (accumulator), with selections from 1 to 15.
   b) Solid-state timer, adjustable from 15 to 300 seconds.
   c) Test switch.
   d) Hand-off-auto switch for chemical pump.
   e) Illuminated legend to indicate feed when pump is activated.
   f) Solid-state lockout timer, adjustable from 15 to 180 minutes, with indicator light. Lockout timer to deactivate the pump and activate alarm circuits.
   g) Electromechanical-type, panel-mounted makeup totalizer to measure amount of makeup water.
3. Control biocide with an adjustable time programmer and include the following:
   a) 24-hour timer with 14-day skip feature to permit activation any hour of day.
   b) Precision, solid-state, bleed-off lockout timer (zero to nine hours) and clock-controlled biocide pump timer (zero to two and one-half hours). Prebleed and bleed lockout.
   c) Solid-state alternator to enable the use of two different formulations.
   d) 24-hour digital display of time of day.
   e) 14-day LED display of day of week.
   f) Fast and slow internal clock set controls.
   g) Battery backup so clock is not disturbed by power outages.
   h) Quartz timekeeping accuracy.
   i) Hand-off-auto switches for biocide pumps.
   j) Biocide A and Biocide B illuminated legends to indicate pump is running.

III. Chemical Treatment Test Equipment

A. Test Kit: Manufacturer recommended equipment and chemicals, in a carrying case, for testing pH, total dissolved solids, dissolved oxygen, biocount, chloride, and total alkalinity and for calcium hardness field tests.

B. Corrosion Test Coupon Assembly: Constructed of corrosion material, complete with piping, valves, and mild steel and copper coupons. Locate copper coupon downstream from mild steel coupon in the test coupon assembly.

IV. Chemicals

A. Furnish chemicals recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment.

B. System Cleaner: Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products.

C. Biocide: Chlorine release agents or microbiocides.

D. Closed-Loop, Water Piping Chemicals: Sequestering agent to reduce deposits and adjust pH, corrosion inhibitors, and conductivity enhancers.

E. Heating Steam and Condensate Piping Chemicals: Sequestering agent to reduce hardness and prevent feedline congestion and to provide alkalinity, oxygen scavenger, carbon-dioxide neutralizer, and filming amines.

F. Open-Loop, Condenser Water Piping Chemicals: Sequestering agent to inhibit scaling, acid to reduce alkalinity and pH, corrosion inhibitor, and biocide.

G. Open-Loop Piping Chemicals Serving Humidifiers, Air Washers, Evaporative Condensers, Small Cooling Towers, and Liquid Coolers: Sequestering agent to inhibit scaling, corrosion inhibitor, and biocide nonoxidizing.

V. Condenser Water Filtration Unit

A. Description: Filtration unit, including sand filter, filter pump, strainer, and controls; factory assembled, piped, and wired; mounted to steel skid.

B. Sand Filter: Glass-fiber-reinforced polyester tank, internal distribution piping, differential gage panel, manual and automatic pressure relief valves, backwash valve, and backwash sight tube; graded silica sand installed according to manufacturer's written instructions.

C. Pump: All-bronze, centrifugal filter pump with totally enclosed, fan-cooled motor; strainer mounted on pump suction; and manually reset, motor-overload switch with pilot light.

1. Comply with requirements in Division 15 Section "Motors."

D. Backwash Control: Automatic, with time clocks and differential pressure switches; mounted in NEMA 250, Type 4 control panel; factory wired for single, external electrical connection.

VI. Hot-water/chilled-water Filtration Unit

A. Filtration Unit: Stainless-steel housing and polypropylene filter with polypropylene core.

B. Replaceable Filter Media: Compatible with antifreeze and water-treatment chemicals.

C. Filter Media for Sediment Removal Service: Rated at 98 percent efficiency for 20-micrometer particulate.

D. Pressure Drop through the Filter Cartridge: Not to exceed manufacturer’s specified rating at design-flow rate when clean or when filter is dirty.

Part 3 - Execution

I. Water Analysis
   A. Perform an analysis of supply water to determine the type and quantities of chemical treatment needed to maintain the water quality as specified in "Performance Requirements" Article.

II. Installation
   A. Install treatment equipment level and plumb.
   B. Add cleaning chemicals as recommended by manufacturer.

III. Connections
   A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
   B. Install piping adjacent to equipment to allow service and maintenance.
   C. Confirm applicable electrical requirements in Division 16 Sections for connecting electrical equipment.
   D. Ground equipment.
      1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

IV. Field Quality Control
   A. Engage a factory-authorized service representative to perform startup service.
      1. Inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
      2. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.
      3. Place HVAC water-treatment system into operation and calibrate controls during the preliminary phase of HVAC systems' startup procedures.
   B. Test chemical feed piping as follows:
      1. Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.
      2. Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

3. Leave uncovered and unconcealed new, altered, extended, and replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow test pressure to stand for four hours. Leaks and loss in test pressure constitute defects.
5. Repair leaks and defects with new materials and retest piping until satisfactory results are obtained.
6. Prepare test reports, including required corrective action.

V. Adjusting

A. Sample boiler water at one-week intervals after boiler startup for a period of five weeks, and prepare certified test report for each required water performance characteristic. Where applicable, comply with ASTM D 3370 and the following standards:
   1. Silica: ASTM D 859.
   2. Steam System: ASTM D 1066.
   3. Acidity and Alkalinity: ASTM D 1067.
   4. Iron: ASTM D 1068.
   5. Water Hardness: ASTM D 1126.

B. Occupancy Adjustments: Within 12 months of Substantial Completion, perform two separate water analyses to prove that automatic chemical feed systems are maintaining water quality within performance requirements specified in this Section. Perform analyses at least 60 days apart. Submit written reports of water analysis to PGCPS Building Services.

VI. Demonstration

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC water-treatment systems and equipment.
   1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.

B. Review manufacturer's safety data sheets for handling of chemicals.

C. Review data in maintenance manuals, especially data on recommended parts inventory and supply sources and on availability of parts and service. Refer to Division 1 Section "Contract Closeout."

D. Review data in maintenance manuals, especially data on recommended parts inventory and supply sources and on availability of parts and service. Refer to Division 1 Section "Operation and Maintenance Data."

E. Schedule at least three days of training with PGCPS Building Services, through Architect, with at least seven days' advance notice.

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 -General Requirements, Section 230100 - General Provisions and Section 230500 - Basic Materials and Methods shall apply to this section.

II. Scope
   A. The work covered under this section of the specifications shall include furnishing and installing the ductwork, accessories, associated items and all necessary connections to outlets, inlets and equipment required for a complete system as shown on the drawings and hereinafter specified.

III. Quality Assurance
   A. Galvanized sheet metal shall meet the requirements of ASTM A653 and A924 standards.
   B. Ductwork and duct accessories shall meet the requirements and recommendations of SMACNA standards, SMACNA Duct Cleanliness for New Construction (Advanced Level), UL-181 standard and ASHRAE recommendations.
   C. The installation of ductwork and duct accessories shall comply with NFPA standard 90A and state and local codes.

IV. Submittals
   A. Provide shop drawings on ductwork materials and accessories as described in Section 230100 - 1.04. Shop drawings are not required for duct layouts.

Part 2 - Products

I. Ductwork System Classification
   A. For determination of ductwork construction criteria, all ductwork systems shall be classified as either low or medium pressure according to the following velocities or pressures. In all cases the higher of the two values shall be used to determine the system classification unless other overriding considerations are established on the drawings or in the specifications. A ductwork system is defined as, the complete run of a supply, return, exhaust, or intake air system, each classified individually.
   B. Ductwork systems with any portion having an average cross-sectional velocity up to and including 2000 FPM and not exceeding 2" w.g. maximum static pressure at any point in the system shall be classified as low pressure. New low pressure ductwork shall be sized

at 0.08 friction loss per 100 linear feet of ductwork. Existing ductwork that will not meet this standard shall not exceed 0.10 friction loss per 100 linear feet of ductwork.

C. Ductwork systems with any portion having an average cross-sectional velocity exceeding 2000 FPM or exceeding 2" w.g. maximum static pressure at any point in the system shall be classified as medium pressure. New low pressure ductwork shall be sized at 0.25 friction loss per 100 linear feet of ductwork. Existing ductwork that will not meet this standard shall not exceed 0.30 friction loss per 100 linear feet of ductwork.

D. All Variable Air Volume (VAV) supply air duct systems and all air duct systems outside exposed to weather regardless of velocity and pressure conditions are classified as medium pressure and shall be constructed in compliance with SMACNA's three (3) inch pressure classification, formerly 'High Pressure Duct Construction Standard.' Joints and seams shall be sealed as described in this specification.

II. Duct Materials

A. All ductwork, housings, dampers, access doors and all other duct related accessories shall be formed from galvanized steel sheets unless otherwise noted.

B. All angles used for reinforcement, support, hanging and other construction uses shall be galvanized steel and shall be equal to that used for ductwork. Galvanized angle iron shall be used where required by SMACNA standards.

III. Ductwork Construction

A. The low pressure ductwork as defined in Article 2.01 shall be constructed in accordance with the one (1) inch pressure classification, as described in SMACNA’s “HVAC Duct Construction Standards – Metal and Flexible”.

B. Ductwork classified as other than low pressure shall be constructed in accordance with the three (3) inch pressure classification, as described in SMACNA’s “HVAC Duct Construction Standards – Metal and Flexible”.

C. Duct sizes are shown on the drawings in inches. The dimensions given establish the free or unobstructed area required on the inside of the duct. In case a duct size is not shown the dimensions shall be requested from the Architect.

D. The ductwork shall be fabricated from field measurements to avoid conflict with beams, columns, pipes and other obstructions. Where necessary to avoid obstructions, the ductwork shall be transformed, divided or moved to one side as long as the free area is not reduced and such changes meet the approval of the Architect.

E. The minimum thickness of the sheet metal shall be either as described in SMACNA’s “HVAC Duct Construction Standards – Metal and Flexible” or as shown in the following table:

DUCT CONSTRUCTION MINIMUM SHEET METAL GAUGES
RECTANGULAR DUCTS

Maximum side (inches)	Steel (Minimum Galvanized Sheet Gauge)	Aluminum (Minimum B & S Gauge)
Thru 12"	26 (0.022 inches)	24 (0.020 inches)
13" - 30"	24 (0.028 inches)	22 (0.025 inches)
31" - 54"	22 (0.034 inches)	20 (0.032 inches)
55" - 84"	20 (0.040 inches)	18 (0.040 inches)
Over 84"	18 (0.052 inches)	16 (0.051 inches)

ROUND DUCTS

Diameter (inches)	SPIRAL SEAM DUCT Steel (Minimum Galvanized Sheet Gauge)	LONGITUDINAL SEAM DUCT Steel (Minimum Galvanized Sheet Gauge)	FITTINGS Steel (Minimum Galvanized Sheet Gauge)
Thru 12"	28 (0.019 in.)	26 (0.022 in.)	26 (0.022 in.)
13" - 18"	26 (0.022 in.)	24 (0.028 in.)	24 (0.028 in.)
19" - 28"	24 (0.028 in.)	22 (0.034 in.)	22 (0.034 in.)
29" - 36"	22 (0.034 in.)	20 (0.040 in.)	20 (0.040 in.)
37" - 52"	20 (0.040 in.)	18 (0.052 in.)	18 (0.052 in.)

F. When required, heavier ductwork shall be installed to meet the requirements of the UL Fire Resistance Index.

G. Where indicated on the drawings or where insufficient space is available for round ductwork, flat oval ductwork may be used. The conversion from round duct sizes to flat oval should be made on an equivalent pressure loss basis, not on an equal cross-sectional area. The flat oval ducts shall be constructed in accordance with current SMACNA standards.

H. Rectangular Duct Section Connections - Shall be as described in the SMACNA Standards. Contractor may use zero leakage four corner bolted companion angle transverse joint as manufactured by DUCTMATE INDUSTRIES, INC. or LOCKFORMER. Joint shall be constructed of galvanized steel with bolting corner pieces, roll formed double wall mating angles, gasketing, mastic sealer and snap-on flange cover cleats.

IV. Flexible Ductwork

A. Where shown on the drawings provide flexible ductwork between branch ducts and terminals or air outlets. It shall be of a low or medium pressure to match duct system served.

B. Ductwork

1. Insulated flexible ductwork shall be factory pre-insulated duct composed of a corrosion-resistant reinforcing wire or band helix permanently bonded and enclosed in polyester film, covered with 1 1/2", 3/4 pound density fiberglass insulation blanket sheathed in a vapor barrier of aluminum polyester film laminated to glass mesh, elastomer back coated. The flexible duct shall be rated for a minimum working velocity of 2000 fpm, shall be listed by Underwriters Laboratories under their UL-181 standards as a Class 1 air duct material and shall comply with NFPA standard No. 90A.

2. Taps for flexible ductwork shall be high efficiency gasketed air-tite type with manual damper

C. The maximum length of flexible duct connection shall be ten feet.

D. Flexible ductwork shall not be used for return air or exhaust air ductwork.

V. Duct Access Doors

A. Duct Access Doors shall be provided in both the low and medium pressure duct systems as shown on the contract drawings and as specified.

B. Access doors shall be constructed as shown in SMACNA standards for the appropriate pressure classification. Door shall be the same gauge and material as the duct. All access doors shall be hinged, except where a removable type is required.

C. The minimum size of all access doors shall be 20" x 14" except where the duct is less than 16", in which case one dimension shall be 20" and the other 2" less than the duct width.

D. Access doors shall be provided in the following locations: At the linkage side of automatic dampers; at the manual volume control dampers; at smoke detection heads; fire dampers; and any other service, balance or control device requiring periodic maintenance.

VI. Flexible Connections At Fan

A. Flexible connections shall be provided at the inlet and outlet connection for each fan, between ductwork and inlet and outlet collars.

B. Each flexible connection shall be designed to allow one inch of free movement and shall be completely air tight and shall have sewed and cemented seams.

C. Flexible connections for low-pressure ductwork shall be in accordance with SMACNA standards. Material shall be neoprene coated glass fabric, 30 oz. per square yard.

D. Flexible connections for medium pressure ductwork shall be the same as for low pressure except additional reinforcing shall be provided as required by the operating pressure of the system.

E. Flexible connections to any roof mounted equipment shall not be exposed to the elements. Flexible connections shall be located inside the building just below the roofline. For side discharge units the flexible connection shall be located inside the building just inside the wall.

VII. Turning Vanes

A. Any square elbow ductwork 18 inches or over in width shall require turning vanes of galvanized steel.

B. Vanes for Low and Medium Pressure Systems: Shall be as shown in SMACNA standards for appropriate pressure classification.

C. Vane lengths shall not exceed 36" for low-pressure systems or 48" for medium pressure systems. Where greater lengths are required, separate banked sections shall be provided.

VIII. Fire, Smoke And Ceiling Dampers.

A. Fire dampers, also known as flame retarding or primary dampers, may be of the individual folded blade type, the continuous folded stainless steel one piece curtain type, the pivoted single blade type or the pivoted multi-blade type, providing they bear a UL label for the complete assembly. Dampers shall be sized so that folded or open blades do not restrict the duct free area given by the duct dimensions. Dampers shall have a positive lock in the closed position. Fusible links shall be UL listed and marked 160oF.

B. Ceiling dampers, also known as radiation shielding or secondary dampers, may be of the single blade spring loaded guillotine type, the continuous folded stainless steel one piece curtain type or the folded approved fire retardant fabric type provided they bear a UL label for the complete assembly. Single protected pivoted blade type ceiling damper constructed in accordance with the requirements of specific UL ceiling assemblies and SMACNA standards and subject to field acceptance may be used where permitted by the conditions of the specific UL ceiling assembly used. Dampers shall be sized so that folded or open blades do not restrict the duct free area given by the duct dimensions. Dampers shall have a positive lock in the closed position. Fusible links shall be UL listed and marked 160oF.

C. Smoke dampers shall meet the requirements of NFPA 90A & 92A and UL5555. Smoke dampers shall be UL Class I smoke damper, normally open and automatically operated by a 120 volt, electric actuator. Provide airfoil style blades. Elevated temperature rating shall be 350°F. Smoke damper shall operate upon activation of smoke detector and re-settable by a locally mounted momentary contact switch.

D. All dampers shall be installed in sleeves a minimum of two gauges heavier than the connecting ductwork unless noted otherwise. Sleeves shall be mounted within and secured to wall, floor, ceiling or other structural penetration. Dampers shall be positioned only as permitted in the UL listing. Connecting ductwork shall be joined to the sleeve so that in the event of damage to the duct system it will break away leaving the fire damper and sleeve intact in the structural penetration. When necessary to avoid obstructions and after acceptance by the Architect, damper dimensions may be different from the connecting ductwork providing the required free area is maintained and 15o maximum transitions are used.

E. Provide UL listed, photoelectric, 120 volt smoke detector for use with smoke damper and 120 volt, reset switch, (normally on, momentary off) mounted within sight of the damper and detector. This switch shall reset the damper and the detector. Smoke detectors shall be rated for air velocities of 500 to 4000 fpm and have integral, auxiliary contacts for “ALARM” and “TROUBLE” annunciation to the fire alarm system.

IX. Manual Volume Control Dampers

A. Manual Volume Control Dampers in ducts not exceeding 12" on the longest side shall be as shown in SMACNA Duct Standards. For ducts over 12", dampers of the opposed multiblade type shall be used. Dampers shall be galvanized steel, swivel end bearings at one end of the blade, and quadrant with level and lock-screw at the opposite end. Multi-blade dampers shall have steel washers at ends of damper rods with self-aligning blade interconnecting hardware.

X. Coated Duct Liner

A. Duct Liner: Low-Pressure Ductwork

1. All plenums and transfer ducts shall receive duct liner. Supply air ductwork shall receive duct liner from the fan discharge to 20 feet downstream from the fan discharge or as otherwise shown. Return air ductwork shall receive duct liner from the fan suction to 20 feet upstream from the fan suction or as otherwise shown. All supply air discharge ductwork from fan coil units shall receive duct liner.
2. Duct liner shall be designed for use as an acoustical and thermal insulation for sheet metal heating and cooling ducts and plenums. The duct liner shall have a density of

1.5 pounds per cubic foot a "K" factor not to exceed .24 @ 50oF mean temperature and a minimum NRC rating of .75. The minimum duct liner thickness shall be 1 inch.

3. Duct liner shall be designed for use as an acoustical and thermal insulation for sheet metal heating and cooling ducts and plenums. The duct liner shall have a density of 1.5 pounds per cubic foot a "K" factor not to exceed .24 @ 50oF mean temperature and a minimum NRC rating of .75. The minimum duct liner thickness shall be 1 inch.
4. Duct liner air stream surface shall be coated with an immobilized, EPA-registered antimicrobial agent so it will not support microbial growth. Duct liner shall be Johns Manville Linacoustic RC. Duct liners with similar characteristics will be considered as long as all aspects of the specifications are met.
5. All duct liner systems will be covered with a perforated-heavy gauge metal liner with a minimum open area of 25%.

B. Duct Liner: Medium Velocity

1. All rectangular supply/return air duct and all air duct outside exposed to weather shall receive duct liner. Rectangular supply air duct shall receive duct liner from the fan discharge to 20 feet downstream from the discharge or as otherwise shown. Return air duct work shall receive duct liner from the fan suction to 20 feet upstream from the fan suction or as otherwise shown.
2. Duct liner shall be designed for use as an acoustical and thermal insulation for sheet metal heating and cooling ducts. The duct liner shall have a density of 1.5 lbs./cu. ft., a 'K' factor not to exceed .24 @ 50 degrees F mean temperature and a minimum NRC rating of .95. The minimum duct liner thickness shall be 2 inches.
3. Duct liner air stream surface shall be coated with an immobilized, EPA-registered antimicrobial agent so it will not support microbial growth. Duct liner shall be Johns Manville Linacoustic RC. Duct liners with similar characteristics will be considered
4. as long as all aspects of the specifications are met.
5. All duct liner systems will be covered with a perforated-heavy gauge metal liner with a minimum open area of 25%.

Part 3 - Execution

I. Duct Installation

A. The ductwork, fittings, access doors, flexible connections, turning vanes, hangers and supports, fire dampers, volume dampers and other accessories shall be installed as recommended by SMACNA Duct Construction Standards. Ductwork shall not be

supported from bottom chords of bar joists, bridging between bar joists or from metal decks. Ductwork shall be supported from the top chords of bar joists.

B. All necessary allowances and provisions shall be made by this contractor for beams, columns or other obstructions of the building or the work of other contractors, whether or not same is indicated. Where necessary to avoid obstructions, the ducts shall be transformed, divided or moved to one side with the required free area being maintained, all as approved or directed by the Architect.

C. Flexible ducts shall be secured to the metal ductwork, terminal units and supply diffusers by use of a 3/4" minimum width stainless steel drawband pulled tight with an adjusting worm drive type screw. Flexible duct insulation shall be properly sealed at connections to maintain vapor seal/barrier.

D. All duct dimensions shown on the drawings are inside clear dimensions. The duct sizes of ducts with duct liner shall be increased accordingly.

II. Duct Liner

A. Duct Liner Application: Coated duct liner shall be cut to assure overlapped and compressed longitudinal corner joints. Apply liner with coated surface facing the air stream and adhere with 100% coverage of fire retardant adhesive. Coat all exposed leading edges and all transverse joints with fire retardant adhesive. The liner shall be additionally secured with mechanical fasteners which shall compress the duct liner sufficiently to hold it firmly in place as follows:

B. Low Velocity to 2000 FPM: Fasteners shall start within 3" of the upstream transverse edge of liner and 3" from the longitudinal joints and shall be spaced at a maximum of 12" o.c. around the perimeter of the duct, except that they may be a maximum of 12" from a corner break. Elsewhere they shall be a maximum of 18" o.c. except that they shall not be more than 6" from a longitudinal joint of liner nor 12" from a corner break. Coat all exposed joints with a fire retardant adhesive.

C. Medium Velocity from 2000 FPM to 4000 FPM - Fasteners shall start within 3" of the upstream transverse edges of the liner and 3" from the longitudinal joints shall be spaced at a maximum of 6" o.c. around the perimeter of the duct, except that they may be a maximum of 6" from a corner break. Elsewhere they shall be a maximum of 16" o.c. except that they shall not be more than 6" from a longitudinal joint of liner nor 12" from a corner break.

D. In addition to adhesive edge coating of transverse joints, any longitudinal joints shall be similarly coated with adhesive.

III. Waterproofing Ductwork Above Roof

A. Exposed ductwork shall be waterproofed with a prefabricated self-adhering, sheet-type waterproofing membrane as manufactured by Venture Tape and offered as VentureClad-1579CW series. Additional manufacturers will be considered providing all aspects of the specifications are met.

B. Materials:

1. Prefabricated, Self-Adhering, Sheet-Type Waterproofing Membrane.

a) Description:

(1) Top Layer: Stucco-embossed, UV-resistant aluminum weathering surface.

(2) Middle Layer: Double layer of high-density polyethylene reinforcement.

(3) Bottom Layer: Uniform layer of rubberized asphalt adhesive, protected by disposable silicone release paper.

(4) Heat Aging, ASTM D 794: No visible blistering or deterioration.

(5) Tear Resistance, ASTM D 1424, Average: 660 grams.

(6) Elongation, ASTM D 412, Minimum: 450 percent.

(7) Low Temperature Flexibility, 1,000,000 Cycles at -10 Degrees F, 1,200 Cycles at 20 Degrees F: No cracking.

(8) Water Vapor Transmission, ASTM E 96: 0.009 perms.

(9) Flame Spread Index, ASTM E 84.0.

(10) Smoke Density Index, ASTM E 84.5.

(11) Wind-Driven Rain, SFBC TAS-110-95, 100 mph: No leakage or failure.

(12) UV Stability: Excellent.

C. Surface Preparation And Application.

1. Prepare surfaces in accordance with manufacturer's instructions.
2. Ensure tops of ducts have sufficient slope to eliminate ponding water.
3. Remove dirt, dust, oil, grease, hand oils, processing lubricants, moisture, frost, and other contaminants that could adversely affect adhesion of waterproofing membrane.
4. Ensure surfaces are clean and dry.
5. Apply membrane to clean, dry, primed metal ductwork and foil-faced rigid insulation boards. Do not apply over wet or nonrigid insulation.
6. Apply membrane in accordance with manufacturer's air, material, and surface temperature requirements.
7. Apply firm, uniform pressure with hand roller to entire membrane to ensure proper adhesion. Concentrate pressure at seams and on underside of ductwork.
8. Apply membrane to ducts in accordance with manufacturer's instructions.
9. Apply membrane shingle fashion to shed water over, not against laps.

10. Do not terminate membrane on bottom of duct.
11. Apply minimum 3-inch side laps and minimum 6-inch end laps for ductwork applications.

IV. Duct Sealing For Variable Air Volume Systems

A. All supply/return air metal and flexible duct joints shall be sealed with water based brush on duct sealant such as FLEX-GRIP 550 as manufactured by Hardcast, Inc.or UNI-FLEX as manufactured by McGill AirSeal LLC and applied in accordance with the manufacturer's directions.

B. Where zero leakage transverse joints as manufactured by DUCTMATE INDUSTRIES or LOCKFORMER are used to join rectangular duct sections additional sealing is not required at those joints unless leakage is revealed during pressure tests.

V. Leakage

A. All low pressure supply, return and outside air ductwork shall be tested and made substantially airtight at static pressure indicated for the system before covering with insulation or concealing in masonry. Substantially airtight shall be construed to mean that no air leakage is noticeable through the senses of feeling or hearing at all duct joints. Supply, return and outside air transverse duct joints shall be sealed a water based brush on duct sealant such as FLEX-GRIP550 as manufactured by HARDCAST or UNI-FLEX as manufactured by McGill LLC.

B. The entire medium pressure ductwork system, including duct runouts to the variable air volume control units, shall be pressure tested for leakage at three (3) inches ductwork static pressure. Perform leakage tests in accordance with the SMACNA HVAC Duct Leakage Test Manual, using test forms equivalent to those outlined in manual. Tests shall be observed by the Architect, Engineer and owner's representative. A test log shall be maintained by the contractor which will contain the results of systems tested and approval from test observer. Copies of the test log will be included in the operation and maintenance manuals.

VI. Cleaning/storage

A. Every effort should be made to ensure the components of the ductwork systems are kept clean and free of dust and debris. Stocked ductwork shall be stored in areas which are away from dust producing operations. Lined ductwork shall be stored in areas which are substantially weather-tight. Should any portion of lined ductwork become water saturated during storage or installation identified sections will be removed and replaced at no additional cost to the owner. As ductwork is being installed any open ductwork shall be temporarily sealed to prevent the ductwork from being contaminated with construction

debris or dust. Temporary filter media shall be installed on the return systems of any equipment which is required to be run as a temporary control during the construction period. Temporary filters shall be monitored and changed frequently to ensure the cleanliness of the ducted systems.

B. After completing installation of ductwork, entire system shall be cleaned of rubbish, plaster, dirt and any other debris. After installation of equipment and connections are made on fan, and before any grilles are installed, entire system shall be blown out with dampers and outlets wide open.

VII. Duct Smoke Detectors

A. Duct smoke detectors shall be furnished under and interconnected between the auxiliary contacts and the fire alarm system by the Division 16 contractor and installed under this section. The duct smoke detectors shall be installed in accordance with the manufacturer's recommendations, NFPA requirements and local fire marshal requirements. Duct smoke detectors shall be mounted to allow full access for service.

VIII. Fire, Smoke And Ceiling Dampers

A. Provide fire dampers where ducts pass through fire-rated components and where required by the local authority. Install in accordance with local codes, NFPA, SMACNA-FSR and manufacturers requirements.

B. Demonstrate the re-setting of the smoke damper and smoke detector to the Fire Marshal and the owner’s representative.

C. All interlock wiring between the 120 volt power supply and devices listed in this section shall be installed under this section. All wiring shall conform to the requirements of Division 16.

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 -General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope
   A. Provide and install the Cabinet and Ceiling Exhaust Fans as shown on the drawings and specified herein.

III. Quality Assurance
   A. Exhaust fan shall have Certified Rating Seal by AMCA and shall be UL listed.

IV. Submittals
   A. Provide shop drawings on this equipment as described in Section 15010 - 1.04.

Part 2 - Products

I. Cabinet And Ceiling Exhaust Fans
   A. The exhaust fan shall consist of a centrifugal type fan with a direct drive motor. Fan shall be of the low sound level type. Motor speed shall not exceed 1100 rpm. Acceptable manufacturers include:
      1. Penn Ventilator Company
      2. Greenheck
      3. Carnes
      4. Loren Cook.

II. Housing
   A. Shall be acoustically insulated and shall be provided with a backdraft damper, motor vibration isolation and electrical connections. Factory air inlet grille shall be provided on ceiling exhaust fans. Cabinet fans shall be arranged for inline duct mounting.

Part 3 - Execution

I. Installation
   A. The exhaust fans shall be installed as recommended by the manufacturer and as shown on the drawings.
   B. Fans shall be controlled as outlined in the Automatic Temperature Control section.

C. Provide three (3) sets of spare fan belts for each unit as required.

D. Provide a typed list of all the different units, their fan belt sizes to be included in the O&M manuals. The list shall include the unit designation, belt size and the number of belts required for each unit. In addition to this, submit to the Owner two additional copies of the list, distributed to the PGCPS project manager of record and PGCPS Building Services.

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 -General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope
   A. Provide and install the Power Roof Ventilator as shown on the drawings and specified herein.

III. Quality Assurance
   A. Power roof ventilators shall have Certified Rating Seal by AMCA or published data by an acceptable manufacturer and shall be UL listed.

IV. Submittals
   A. Provide shop drawings on this equipment as described in Section 230100 - 1.04.

Part 2 - Products

I. Power Roof Ventilator
   A. The power roof ventilator shall be the type, capacity and drive (belt drive or direct drive), and be located as shown on the drawings. Acceptable manufacturers include:
      1. Penn Ventilator Company
      2. Greenheck
      3. Loren Cook
      4. Carnes.
   B. Fan - Shall be provided with a backward inclined centrifugal wheel that has been statically and dynamically balanced. The bearings shall be heavy duty, self-aligning, sealed ball bearings. The motor and fan assembly shall be isolated from the base with rubber-in-shear vibration isolators.
   C. Belt drive ventilators shall have variable speed sheave pulley to adjust the speed of the ventilator.
   D. Motor - Shall be installed in a totally enclosed weatherproof housing outside of the air stream. The motor shall have internal thermal protection and sealed ball bearings.
   E. Disconnect Switch - A factory wired non-fused toggle type disconnect switch shall be located under the housing of the unit.

F. Starter - Provide a magnetic across-the-line starter for three phase units. See Section 15050 - 2.07.

G. Pre-fabricated aluminum or galvanized steel curbs 12" high shall be provided to match the power roof ventilator. The curb shall be flashed to match the roofing system. Provide wood nailer. The power roof ventilator and curb shall be provided by the same manufacturer. Backdraft dampers shall be mounted in the curb and shall be full size of the opening.

H. Accessories shall be provided as shown on the drawings. Such accessories shall be of the same manufacturer as the ventilators. All ventilators shall have gravity type backdraft dampers.

I. Unit shall be controlled as described in the Automatic Temperature Control section of the specifications.

Part 3 - Execution

I. Installation

A. The power roof ventilator shall be installed as recommended by the manufacturer and as shown on the drawings. Backdraft damper shall be mounted on rails inside the curb and within the manufacturers recommended minimum distance from the fan. The power roof ventilator shall be secured to the roof curb using like fasteners, fasteners shall be self tapping stainless steel with a 5/16 hex head, 2 inches in length. The number of fasteners used shall be per the manufacturers' recommendations.

B. Variable Sheave Pulley

1. If the belt drive power roof ventilators do not have a variable speed sheave pulley, the contractor shall provide and install pulley and belts to meet the air flow requirements as shown on the drawings.

C. Provide three (3) sets of spare fan belts for each unit as required.

D. Provide a typed list of all the different units, their fan belt sizes to be included in the O&M manuals. The list shall include the unit designation, belt size and the number of belts required for each unit. In addition to this, submit to the Owner two additional copies of the list, distributed to the PGCPS project manager of record and PGCPS Building Services.

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 -General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope
   A. Provide and install the fly fans as shown on the drawings and specified herein.

III. Quality Assurance
   A. The fly fan shall have Certified Rating Seal by AMCA or published data by an acceptable manufacturer and shall be UL listed.

IV. Submittals
   A. Provide shop drawings on this equipment as described in Section 230100 - 1.04.

Part 2 - Products

I. Fly Fans
   A. The fly fans shall be of the type, capacity and voltage shown on the drawings. Acceptable manufacturers include:
      1. Mars
      2. Fantech
      3. Powered Aire
      4. Berner Miniveil.
   B. Cabinet - Shall be suitable for exposed indoor wall mounting and manufactured of polycarbonate or satin anodized aluminum painted with color selected by Architect. The air shall enter the fan through a horizontal louvered inlet grille. Air shall be diffused through a nozzle that extends the entire width of the unit and is equipped with air directional control vanes. Velocity control shall be through two speed motor control or adjustable intake louver damper control.
   C. Fan and Motor - Shall be direct drive, forward curved, centrifugal, continuous duty type with permanently lubricated sealed ball bearings and automatic thermal overload protection. The fans shall be selected for quiet operation with motor speed not exceeding 1750 rpm.

Part 3 - Execution

I. Installation

A. The fly fans shall be installed as recommended by the manufacturer and as shown on the drawings.

B. Fans shall be controlled through a remote mounted wall switch.

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 - General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope
   A. Provide and install the air terminal units as shown on the drawings and specified herein.

III. Quality Assurance
   A. Air terminal units shall be rated by a recognized testing agency such as the Air Diffusion Council, ASHRAE Standard 36-72, Air Movement and Control Association International, Inc., or an acceptable manufacturer's test laboratory.

IV. Submittals
   A. Provide shop drawings on this equipment as described in Section 230100 - 1.04. Shop drawings shall include proposed uses of all items.

Part 2 - Products

I. Fan Powered Variable Air Volume and Constant Volume Terminal Units
   A. Provide and install fan powered terminals with electrically driven fan and automatically controlled modulating damper. Unit shall supply a constant volume of air to the space by mixing of the primary conditioned variable air with ceiling plenum return air as described herein and shown on the drawings. Capacities shall be as shown in the equipment schedule. Acceptable manufacturers include:
      1. Environmental Technologies
      2. Carrier
      3. Titus
      4. Trane
   B. Air Controlling Assembly - Shall consist of volume regulator, air flow throttling control device, device operator, and adjustment points, Regulator shall compensate for static pressure fluctuations by repositioning damper operator and shall act as reversing relay. Provide normally closed actuators for units with integral heating coils.
   C. Cabinet shall be galvanized steel wrap around one-piece structural frame with all exposed edges flanged and interior of discharge section insulated. Mixing section shall

have single blade gasketed minimum leakage damper. Fans shall be centrifugal forward curved double width mounted on double-shafted three-speed permanent split capacitor motor. Fan wheels and housing shall be constructed of non-corrosive material.

D. Coils - Shall be constructed of aluminum fins mechanically bonded to seamless copper tubes, with continuous fin collars and sleeved coil and supports. Coils shall be factory leak tested at a minimum 300 psi.

E. Unit Supports - Control units and slot type diffusers shall be located as shown on drawings and shall be independently supported with mounted channel and SMACNA approved hanger strap.

F. Filters – Shall be throwaway type.

G. The Sound Power Levels (10 - 12 watts) generated when producing the specified cfm shall not exceed the following figures in any octave band.

Octave Band	2	3	4	5	6	7	8
Center Frequency	125	250	500	1000	2000	4000	8000
Sound Power Level	73	69	66	59	54	53	56

H. Fan and damper controls shall be furnished and installed under the Automatic Temperature Control section of the specification. The division 15900 contractor shall furnish and ship direct digital controllers to the terminal equipment manufacturer for factory installation. The division 15900 contractor shall provide the equipment manufacturer with the necessary wiring diagrams and mounting instructions. The terminal equipment manufacturer shall furnish transformers, relays, airflow sensors and enclosures.

II. Shut-Off Type Variable Air Volume (VAV) Equipment Terminal Units

A. Provide shut-off type air terminal components of an automatically controlled variable air volume system as described herein and shown on the drawings. The system shall consist of air modulating control units serving remote diffusers. Capacities shall be as shown in the equipment schedule. Acceptable manufacturers include:

1. Environmental Technologies
2. Carrier
3. Titus

4. Trane

B. VAV box manufacturer shall provide all necessary transformers, relays, airflow rings and enclosures. The division 15900 contractor shall furnish and ship the direct digital controllers and actuators to the equipment manufacturer for installation. The division 15900 contractor shall provide the equipment manufacturer with the necessary wiring diagrams and mounting instructions.

C. Air Control Units - Shall regulate the air volume delivered to diffusers either mounted on the unit or remotely connected by ductwork. Units shall be constructed of heavy gauge galvanized steel. All interior surfaces shall be acoustically and thermally insulated with glass fiber material, surface treated to prevent erosion. Insulation shall be U/L listed and meet NFPA requirements. Provide hanger holes at all four corners. Minimum box setting shall be factory adjusted to minimum airflow shown in the equipment schedule.

D. Automatic Temperature Control System - Damper operator shall be controlled by a remote sensor as described in the temperature control section of the specifications.

E. Air Controlling Assembly - Shall consist of volume regulator, airflow throttling control device, device operator, and adjustment points. Regulator shall compensate for static pressure fluctuations by repositioning damper operator and shall act as a reversing relay. Provide normally open direct acting actuator or provide the necessary reversing relay to meet this requirement.

F. Hot Water Coils - Shall be constructed of aluminum fins mechanically bonded to seamless copper tubes, with continuous fin collars and sleeved coil and supports. Coil shall be factory leak tested at minimum 300 psi.

III. Motorized Dampers

A. Motorized dampers shall be low leakage opposed blade galvanized steel type with 16 gauge frame and 16 gauge blades. Maximum blade width 8". Provide neoprene seals at all blade edge and side meeting surfaces so that air leakage shall be no more than 1% at 4" static pressure. Provide Teflon or oil impregnated bronze shaft bearings and standard finish. Acceptable manufacturers include:

1. Ruskin
2. Penn Ventilator
3. Carnes.

Part 3 - Execution

I. Installation

A. Shall be installed in accordance with the manufacturers' recommendations. For the Variable Air Volume Terminal Units, the first unit installed will be considered the typical mock up and shall require notification, inspection and approval by designated owner representative and/or architect and engineer before any additional installations will be allowed.

B. Filters - Shall be changed at the end of the construction period and before the final inspection. Provide a typed list of all the different units and their filter sizes to be included in the O&M manuals. The list shall include the unit designation, filter size and the number of filters required for each unit. Provide three (3) sets of filters as required at closeout. In addition to this, submit to the Owner two additional copies of the list, distributed to the PGCPS project manager of record and PGCPS Building Services.

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 -General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope
   A. Provide and install the diffusers, registers and grilles as shown on the drawings and specified herein.

III. Quality Assurance
   A. Air outlets and inlets shall be rated by a recognized testing agency such as the Air Diffusion Council, ASHRAE Standard 36-72, Air Movement and Control Association International, Inc., or an acceptable manufacturer's test laboratory.

IV. Submittals
   A. Provide shop drawings on this equipment as described in Section 230100 - 1.04. Shop drawings shall include proposed uses of all items.

Part 2 - Products

I. Diffusers, Registers, and Grilles
   A. The grilles, registers and ceiling diffusers shall be provided as shown on the drawings along with accessories as required. Acceptable manufacturers include:
      1. Titus
      2. Nailor
      3. Price
      4. Metalaire.
   B. Supply Air Diffuser, Ceiling, Square: lay-in type, steel, stamped type, fixed pattern, square louvered face, opposed blade volume damper, equalizing grid, (combination damper/grid are not acceptable) white powder coat finish. Price model SCD.
   C. Supply Air Louver, Exposed Duct Mounting, Drum Louver: Aluminum, adjustable pattern, aluminum finish with volume damper. Price model HCD1.
   D. Supply Air Registers: Steel adjustable vanes, double deflection, vertical front vanes, opposed blade dampers, Aluminum finish. Price model 520D.
   E. Air Extractor: Pivoted adjusting curved blades with adjusting strap. Price model AE1.

F. Return Air Grille, Ceiling: Steel individual fixed horizontal face bars, 0° deflection, white finish, size shall be minimum 12” x 24”. Price model 510HZ.

G. Return Air Grille, Wall: Steel, individual fixed horizontal face bars, 40° deflection, heavy duty type, aluminum finish. Price model 91.

H. Return Air Register, Ceiling: Steel, individual fixed horizontal face bars, 0° deflection, volume damper, white enamel finish. Price model 510ZD. Exhaust air register shall be the same except aluminum, Price model 610ZD.

I. Linear Slot Diffuser: Aluminum, adjustable blades, 1” slot with 1” frame, standard frame finish white, mounting hardware, 1” end caps at both ends, blank sections as required. Remove blades when used as a return. Coordinate with drawings for frame type, number of slots and length. Price model SDS100 Frame 2.

Part 3 - Execution

I. Installation

A. The grilles, registers and ceiling diffusers shall be installed in accordance with the manufacturer's recommendations. Dampers shall be installed where shown and where required to balance the air system.

B. Before locating grilles and ceiling diffusers, check the Architectural and Electrical drawings to make sure that there is no conflict with floor moldings, electrical outlets, lighting fixtures or any other obstruction. Low sidewall grilles and registers shall be mounted with the bottom edge eight inches above the floor with the vanes turned down. High sidewall grilles and registers shall be mounted six inches below the ceiling or as shown on architectural drawings.

C. Air extractors shall be provided and installed as shown on the drawings. Provisions shall be made to adjust air extractor from the exterior of the ductwork. When air extractor is installed, no damper for the register is required.

END OF SECTION

Part 1 - General

I. Related Documents
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

II. Summary
   A. This Section includes the following:
      1. Listed chimney liners.
      2. Listed double-wall vents.
      3. Field-fabricated metal breechings and chimneys.

III. Submittals
   A. Product Data: For the following:
      1. Chimney liners.
      2. Type B and BW vents.
      3. Type L vents.
      4. Special gas vents.
      5. Building-heating-appliance chimneys.
      6. Grease ducts.
      7. Refractory-lined metal breechings and chimneys.
      8. Guy wires and connectors.
   B. Shop Drawings: For vents, breechings, chimneys, and stacks. Include plans, elevations, sections, details, and attachments to other work.
      1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, methods of field assembly, components, hangers and seismic restraints, and location and size of each field connection.
      2. For installed products indicated to comply with design loads, include calculations required for selecting seismic restraints and structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   C. Welding certificates.
   D. Warranties: Special warranties specified in this Section.

IV. Quality Assurance
   A. Source Limitations: Obtain listed system components through one source from a single manufacturer.

B. Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel," for hangers and supports and AWS D9.1, "Sheet Metal Welding Code," for shop and field welding of joints and seams in vents, breechings, and stacks.

C. Certified Sizing Calculations: Manufacturer shall certify venting system sizing calculations.

V. Coordination

A. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

VI. Warranty

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of venting system that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, structural failures caused by expansion and contraction.

B. Warranty Period: 10 years from date of Substantial Completion.

Part 2 - Products

I. Manufacturers

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

II. Listed Chimney Liners

A. Manufacturers:

1. American Metal Products; MASCO Corporation.
2. Deflect-O Corp.
3. Heat-Fab Inc.
4. Industrial Chimney Company.
5. Metal-Fab, Inc.
6. Pringle Power-Vac, Inc.
7. ProTech Systems Inc.
8. Selkirk Inc.; Selkirk Metalbestos and Air Mate.

9. Shook Manufactured Products, Inc.
10. Simpson Dura-Vent Co., Inc.; Subsidiary of Simpson Manufacturing Co.
11. Tru-Flex Metal Hose Corp.
12. Approved Equal.

B. Description: Straight, single-wall chimney liner tested according to UL 1777 and rated for 1000 deg F continuously, or 2100 deg F for 10 minutes; with negative or positive flue pressure complying with NFPA 211 and suitable for general usage.

C. Straight Liner Materials: ASTM A 666, Type 304 stainless steel.

D. Corrugated Liner Materials: ASTM A 240/A 240M, Type 321.

E. Accessories:

1. Fittings: Tees, elbows, increasers, draft-hood connectors, metal caps with bird barriers, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar or compatible materials and designs.
2. Sealant: Manufacturer's standard high-temperature sealant.
3. Insulating Fill: Manufacturer's standard high-temperature insulation fill material in annular space surrounding chimney liner including high-temperature, ceramic-fiber insulation required to seal chimney at top and bottom.

III. Listed Type b And Bw Vents

A. Manufacturers:

1. American Metal Products; MASCO Corporation.
2. FAMCO.
3. Hart & Cooley, Inc.
4. Heat-Fab Inc.
5. Industrial Chimney Company.
6. LSP Products Group, Inc.
7. Metal-Fab, Inc.
8. ProTech Systems Inc.
9. Schebler Co. (The).
10. Selkirk Inc.; Selkirk Metalbestos and Air Mate.
11. Simpson Dura-Vent Co., Inc.; Subsidiary of Simpson Manufacturing Co.
12. Tru-Flex Metal Hose Corp.
13. Van-Packer Co.
14. Approved Equal.

B. Description: Double-wall metal vents tested according to UL 441 and rated for 480 deg F continuously for Type B, or 550 deg F continuously for Type BW; with neutral or negative flue pressure complying with NFPA 211 and suitable for certified gas-fired appliances.

C. Construction: Inner shell and outer jacket separated by at least a 1/4-inch airspace.

D. Inner Shell: ASTM B 209, Type 1100 aluminum.

E. Outer Jacket: Galvanized steel.

F. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.

1. Termination: Stack cap designed to exclude 90 percent of rainfall.

IV. Listed Type I Vent

A. Manufacturers:

1. American Metal Products; MASCO Corporation.
2. FAMCO.
3. Heat-Fab Inc.
4. Industrial Chimney Company.
5. LSP Products Group, Inc.
6. Metal-Fab, Inc.
7. ProTech Systems Inc.
8. Schebler Co. (The).
9. Selkirk Inc.; Selkirk Metalbestos and Air Mate.
10. Simpson Dura-Vent Co., Inc.; Subsidiary of Simpson Manufacturing Co.
11. Tru-Flex Metal Hose Corp.
12. Van-Packer Co.
13. Approved Equal.

B. Description: Double-wall metal vents tested according to UL 641 and rated for 570 deg F continuously, or 1700 deg F for 10 minutes; with neutral or negative flue pressure complying with NFPA 211 and suitable for low-heat appliances.

C. Construction: Inner shell and outer jacket separated by at least a 1-inch airspace filled with high-temperature, ceramic-fiber insulation.

D. Inner Shell: ASTM A 666, Type 304 stainless steel.

E. Outer Jacket: Galvanized steel.

F. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.

1. Termination: Stack cap designed to exclude 90 percent of rainfall.

V. Listed Special Gas Vent

A. Manufacturers:

1. Heat-Fab Inc.
2. Metal-Fab, Inc.
3. ProTech Systems Inc.
4. Z-FLEX.
5. Approved Equal.

B. Description: Double-wall metal vents tested according to UL 1738 and rated for 480 deg F continuously, with positive or negative flue pressure complying with NFPA 211 and suitable for condensing-gas appliances.

C. Construction: Inner shell and outer jacket separated by at least a 1/2-inch airspace.

D. Inner Shell: ASTM A 959, Type 29-4C stainless steel.

E. Outer Jacket: Stainless steel.

F. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.

1. Termination: Stack cap designed to exclude 90 percent of rainfall.

VI. Listed Building-heating-appliance Chimneys

A. Manufacturers:

1. American Metal Products; MASCO Corporation.
2. FAMCO.
3. Hart & Cooley, Inc.
4. Heat-Fab Inc.
5. Industrial Chimney Company.
6. LSP Products Group, Inc.
7. Metal-Fab, Inc.
8. ProTech Systems Inc.
9. Schebler Co. (The).

10. Selkirk Inc.; Selkirk Metalbestos and Air Mate.
11. Simpson Dura-Vent Co., Inc.; Subsidiary of Simpson Manufacturing Co.
12. Tru-Flex Metal Hose Corp.
13. Van-Packer Co.
14. Approved Equal.

B. Description: Double-wall metal vents tested according to UL 103 and 959 and rated for 1400 deg F continuously, or 1800 deg F for 10 minutes; with positive or negative flue pressure complying with NFPA 211 and suitable for dual-fuel boilers, oven vents, water heaters, or exhaust for engines.

C. Construction: Inner shell and outer jacket separated by at least a 2-inch annular space filled with high-temperature, ceramic-fiber insulation.

D. Inner Shell: ASTM A 666, Type 304 stainless steel.

E. Outer Jacket: Stainless steel.

F. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.

1. Termination: Round chimney top designed to exclude 98 percent of rainfall.

VII. Listed, Refractory-lined Metal Breechings And Chimneys

A. Manufacturers:

1. Van-Packer Co.
2. Warren Environment, Inc.
3. Approved Equal.

B. Comply with ASME STS-1-1992.

C. Design Wind Loads: 150 mph.

D. Design for seismic conditions at Project site.

E. Chimney Outer Jacket: Aluminized steel with riveted or welded seams.

F. Refractory Lining: Tested according to UL 959 for temperature and acid resistance, and bearing the testing laboratory label.

1. Temperature Rating: 1800 deg F continuously, and 2000 deg F intermittently.
2. Acid Extraction: Maximum of 0.2 percent.
3. Cold Crushing Strength: Minimum of 3200 psig.
4. Thickness: Minimum of 2 inches.

G. Finish: Factory-applied, high-heat-resistant paint; color as selected by Owner.

H. Base Section: Acid-resistant-coated, cast-iron anchor lugs for securing stack to foundation with anchorage designed by manufacturer.

I. Reinforced Cleanout Section: Smoke-tight connection, with gasketed and bolt-tightened inspection plate; neck shall be welded to stack section.

J. T- or Y- Sections: Smoke-tight connection, with welded joints and refractory lining; finished with smooth transition and with no exposed metal on inside.

K. Spark Screen: ASTM A 666, Type 316 stainless steel, 0.0625 inch thick, maximum 1/2-by-1/2-inch mesh, with ASTM A 666, Type 304 stainless-steel rolled angle and drawband.

L. Guy Bands: 8-inch- wide bands of same material as jacket, with bolted fasteners.

M. Roof Penetration: Factory-fabricated thimbles, flashings, and counterflashings.

N. Fabricate sections, fittings, and accessories as individual pieces or in combination lengths for field handling.

O. Fabricate components with centrifugally cast refractory lining in lengths suitable for connection with drawbands.

P. Bond refractory to steel jacket with calcium aluminate cement to prevent separation in finished product during shipping, handling, and installation.

Q. Fabricate stacks with anchor lugs; cleanout; T-sections; flashings and counterflashings; and provisions for support, expansion, and contraction.

Part 3 - Execution

I. Examination

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

II. Installation Of Listed Vents And Chimneys

A. Locate to comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.

B. Seal between sections of positive-pressure vents according to manufacturer's written installation instructions, using sealants recommended by manufacturer.

C. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.

D. Slope breechings down in direction of appliance, with condensate drain connection at lowest point piped to nearest drain.

E. Connect base section to foundation using anchor lugs of size and number recommended by manufacturer.

F. Join sections with acid-resistant joint cement to provide continuous joint and smooth interior finish.

G. Erect stacks plumb to finished tolerance of no more than 1 inch out of plumb from top to bottom.

III. Cleaning

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

B. Clean breechings internally, during and after installation, to remove dust and debris. Clean external surfaces to remove welding slag and mill film. Grind welds smooth and apply touchup finish to match factory or shop finish.

C. Provide temporary closures at ends of breechings, chimneys, and stacks that are not completed or connected to equipment.

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 -General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope
   A. Provide and install a complete factory-built vent system as called for on the drawings.

III. Quality Assurance
   A. The vents shall meet the requirements of NFPA standards and The International Fuel Gas Code, be UL listed, and satisfy all state and local codes.

IV. Submittals
   A. Provide shop drawings on this equipment as described in section 230100.

Part 2 - Products

I. Gas Fired Boiler Vents
   A. Provide and install the boiler vents complete as shown on the drawings and specified herein. The vents shall be UL listed for this application and meet the requirements of NFPA standard No. 211. The boiler vent shall be double walled using AL29-4C stainless steel. Acceptable manufacturers include:
      1. Selkirk model SAF-T Vent CI Plus
      2. Metal-Fab
      3. Schebler.

II. Gas Fired Water Heater Vent
   A. Provide and install the water heater vent complete as shown on the drawings and specified herein. The vents shall be UL listed for this application and meet the requirements of NFPA standard No. 54 and/or No. 211. The water heater vent for atmospheric type heaters shall be model RV for 3” to 8” and model QC for 10” vents. The water heater vent for power burner type heaters shall be model PS. High efficient condensing water heater vent shall be double walled using AL29-4C stainless steel. Acceptable manufacturers include:
      1. Selkrik model SAF-T Vent CI
      2. Metal-Fab
      3. Schebler.

Part 3 - Execution

I. Gas Fired Boiler Vents

A. The boiler vents shall be installed in accordance with the manufacturer's recommendations and to meet the requirements of NFPA No. 211, state and local codes. Provide barometric dampers when recommended by boiler manufacturer.

II. Water Heater Vent

A. The water heater vent shall be installed in accordance with the manufacturer's recommendations and to meet the requirements of NFPA No. 54 and/or No. 211, state and local codes. Provide barometric dampers when recommended by water heater manufacturer.

III. Connections To Chimneys

A. Vent connections to chimneys shall be made with thimbles. The thimble shall be permanently cemented in place, utilizing heat-resistant cement. The metal vent shall be flush with the inside wall of the chimney.

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 - General Requirements, Section 15010 - General Provisions, and Section 15050 - Basic Materials and Methods, shall apply to this section.

II. Scope
   A. The work covered under this section shall include Electric heating boilers as specified in this section.

III. Quality Assurance
   A. Referenced codes and standards include:
      1. American Boiler Manufacturers Association (ABMA)
      2. American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
         a) CSD-1: Controls and Safety Devices for Automatically-Fired Boilers; Boiler and Pressure Vessel Code, Section IV: Heating Boilers
      3. National Board of Boiler and Pressure Vessel Inspectors (NBBPVI)
      4. National Fire Protection Association (NFPA)
         a) 70: National Electric Code (NEC)
      5. Underwriters Laboratories, Inc. (UL)
         a) 834: Electric Heating, Water Supply and Power Boilers Labeling and Listing Requirements
      6. Prince George's County Building Codes
      7. International Mechanical Code
      8. State of Maryland Regulations Governing Boilers and Unfired Pressure Vessels

IV. Submittals
   A. Provide shop drawings including predicted performance data, design, fabrication and installation details. Include piping and wiring diagrams, and shipping and operating weights.
   B. Provide minimum 1-year warranty, required product certifications and operating permits for all equipment.

Part 2 - Products

I. Electric Boilers

A. Provide electric immersion element packaged [hot water] [steam] boiler.. Acceptable manufacturers include:

1. Lochinvar
2. Fulton
3. Smith.

B. Boiler burner package, including accessories, controls and boiler trim, all factory mounted and wired, shall be approved as a unit by Underwriters Laboratories, Inc., and furnished with a guarantee that it will meet all required regulations.

C. Entire boiler and components shall be factory-assembled, wired and tested, and shall require only external field piping and wiring connections.

D. Boiler shall be UL listed and bear the UL label.

II. Vessel

A. Boiler vessel shall be vertically constructed in compliance with ANSI/ASME Boiler and Pressure Vessel Code, Section IV, and shall be National Board inspected and bear "H" stamp for pressure as required or scheduled steam operating pressure.

B. Vessel liner shall be equal to “Pre-Krete” Formula G-8. Liner shall be an aluminum silicate cement lining designed for a boiler system operating at maximum of 1000 degrees F. Lining shall be non-toxic.

C. Pressure relief valve shall be ASME, NB rated, and set at pressure rating as scheduled.

D. For boilers 400 hp and smaller, insulate vessel with 2 inch thick, 1.5 pcf density fiberglass insulation.

E. For boilers larger than 400 hp, insulate vessel with 4 inch thick, 1.5 pcf density fiberglass insulation.

III. Heating Elements

A. Heating elements shall be capacity and voltage as required, Incoloy sheathed immersion elements, mechanically mounted and field replaceable without welding or brazing.

B. Heating element watt density shall not exceed 75 Watts per square inch.

IV. Boiler Trim

A. The boiler trim for each boiler shall include the following:

1. First on/first off progressive sequencing control with recycle relay.
2. Operating aquastat.
3. High-limit aquastat.

4. Safety high-limit aquastat with manual reset.
5. Integral contactors.
6. Supplemental internal circuit protection fuses, current-limiting, rated at required amperage interrupting capacity.
7. Main lugs for supply circuits.
8. 120 volt, fused control circuit, including control transformer.
9. Integral high temperature/high pressure limit control.
10. Low water-level cutoff (with manual reset and push-to-test feature).
11. External interlock terminals.
12. On/off control switch.
13. Step-indicating lights (one (1) per step).
14. ASME-rated pressure relief valve.
15. Pressure/temperature gage.
16. Drain valve.
17. Power panel electric door interlock.
18. Alarm bell with silence switch.
19. Flow switch.
20. Common alarm contacts for remote alarm indication. Dry contacts for start/stop and status indication.
21. Fused disconnect switch.
22. Molded case circuit breaker with ground fault protection.

V. Temperature Control System

A. Modulating control shall be a 20-step control design featuring solid-state circuitry with modulating control to proportion power input to system demand. Control shall provide an adjustable time delay between steps and shall include a recycle feature to cause boiler to always start at unloaded condition on startup or after a power outage of more than a few seconds.

B. Modulating control shall maintain one of the following as required:
   1. Leaving Water Temperature (LWT) as scheduled at full or part load, within plus or minus 5 degrees F of specified temperature
   2. Leaving Steam Pressure (LSP) as scheduled at full or part load, within plus or minus 2 psi of specified pressure.

C. Step control shall be a progressive sequencing type and shall equalize number of cycles of operation of components controlled by step control. At each increase in load, heating

elements that have been off the longest shall be next to be energized. At each decrease in load, elements that have been on the longest shall be next to be deenergized.

D. Provide manually-adjustable kW demand limiting control.

E. Provide adjustable (weekly/monthly) surface blowdown control with adjustable (0 to 60 second) duration.

F. External to this boiler package, a multiple boiler sequencer for lead/lag control with other boilers will be provided by Others under Division 13. Under such control, this boiler may then, at option of the operator, be operated as a summer boiler, or as a supplemental boiler in a boiler sequence, for optimum plant efficiency.

VI. Lead-Lag Controller

A. Provide a lead-lag sequence controller to control the operation of boilers with modulating combustion control.

B. Lead-lag controller shall include lead-lag selector switch relays, status indicating lights, and fused power switch. Controller shall be factory wired and tested.

C. Controller shall be shipped loose for field mounting within 20 feet of the boilers.

D. Lead-lag controller shall be Cleveland Controls, Inc. Master Sequence Programmer Series "C" or approved equal.

VII. Enclosure

A. Mount boiler on a structural steel base, full size for boiler enclosure.

B. Electrical control panel shall be No. 14 gage steel. Vessel enclosure shall be No. 18 gage steel.

C. Finish entire enclosure in baked enamel.

Part 3 - Execution

I. Installation

A. Mount boiler(s) on concrete foundation and/or mounting structure as required by manufacturer.

B. Install the work in accordance with manufacturer's written instructions, approved submittals, and in compliance with all referenced codes and ordinances.

C. Connect all piping to boiler(s) in accordance with the Specification Sections referenced under Article, Related Work Specified Elsewhere (Non-inclusive), and as indicated on the Drawings.

D. Provide field control wiring of boiler, boiler control panel, boiler annunciator, multiple boiler control panel, automatic damper blade end switches, and their associated sensors in accordance with the requirements of Division 16.

E. Equipment dimensions shall be such that it will adequately fit into the mechanical space and shall, when installed, fit within the allocated space indicated on Drawings.

F. All boiler, burner and auxiliary components shall be delivered, unloaded and stored in an area adjacent to the erection location as directed by Owner.

G. Lead-lag controller and other auxiliaries that are shipped loose shall be installed and wired in accordance with the Contract Documents after the Mechanical Installer has completed all of the piping and power wiring work.

H. Installation of boiler, burner and controls shall be coordinated with PGCPS and the Mechanical Installer.

I. Startup and one-year service shall be included for each boiler.

J. Provide an engraved nameplate permanently affixed to the front of the control cabinet (inside of cabinet for outdoor locations) with the following information:

UNIT #	*(unit number)*
INSTALLED BY:	*(contracting company's name)*
WARRANTY EXPIRES:	*(month/day/year)*
COMPRESSOR WARRANTY EXPIRES:	*(month/day/year)*

II. Manufacturer's Services

A. After the boiler, piping and electrical systems have been completed by the Mechanical Installer, each boiler shall be operated by the boiler manufacturer under actual operating conditions to demonstrate to PGCPS and the Design Professional that they meet the design requirements.

B. Operation and test shall be no less than twenty four (24) hours for each boiler.

END OF SECTION

Part 1 - General

I. General

A. The Bidding and Contract Requirements, Division 1 - General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope

A. The work covered under this section shall include packaged, factory-fabricated and -assembled, gas-fired condensing boilers, trim, and accessories for generating hot water.

III. Quality Assurance

A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of condensing hydronic boilers with welded steel pressure vessels, whose products have been in satisfactory use in service for not less than twenty-five (25) years. The manufacturer must be privately owned and located in North America. The boilers must be manufactured in North America and be able to participate in projects that require a level of content for boiler materials. The specifying engineer, contractor and end customer must have the option to visit the factory during the manufacture of the boilers and be able to witness test fire and other relevant procedures.

B. Referenced codes and standards include:

1. American Boiler Manufacturers Association (ABMA)
2. American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
    a) CSD-1: Controls and Safety Devices for Automatically-Fired Boilers; Boiler and Pressure Vessel Code, Section IV: Heating Boilers
3. ASTM International (ASTM)
    a) D 396: Specification for Fuel Oils (if required)
4. Factory Mutual Global System (FMG) Approval Guide
5. Hydronics Institute (HI)
    a) S-B-R Steel Boiler Ratings
6. General Electric Global Asset Protection (GE GAP) Approval Guide
7. National Fire Protection Association (NFPA)
    a) 85: Boiler and Combustion Hazards Code
8. Underwriters Laboratories, Inc. (UL)

9. Prince George's County Building Codes
10. International Mechanical Code

IV. Submittals

A. Provide shop drawings including predicted performance data, design, fabrication and installation details. Include piping and wiring diagrams, and shipping and operating weights.

B. Warranty

1. The boiler manufacturer will repair or replace any part that is found to be defective in workmanship or material within eighteen (18) months of shipment from the factory or twelve (12) months from start-up, whichever comes first.
2. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period.
   a) Warranty Period for Pulse-Combustion Boilers:
      (1) Heat Exchanger Damaged by Thermal Shock: Ten (10) years from date of Substantial Completion.
      (2) Heat-Exchanger Corrosion: Nonprorated for five (5) years from date of Substantial Completion.
      (3) Flue Gas Corrosion and/or defective material or workmanship: five (5) years from the date of shipment from the factory. The manufacturer will repair, replace, exchange or credit at the option of PGCPS.
   b) Warranty Period for Fire-Tube Condensing Boilers:
      (1) Leakage and Materials: Ten (10) years from date of Substantial Completion.
      (2) Heat Exchanger Damaged by Thermal Stress and Corrosion: Nonprorated for five (5) years from date of Substantial Completion.
      (3) Flue Gas Corrosion and/or defective material or workmanship: Five (5) years from the date of shipment from the factory. The manufacturer will repair, replace, exchange or credit at the option of PGCPS.
   c) Warranty Period for Water-Tube Condensing Boilers: Twenty (20) years from date of Substantial Completion.
   d) Warranty Period for Water-Jacketed Condensing Boilers:
      (1) Leakage and Materials: Eight (8) years from date of Substantial Completion.

(2) Heat Exchanger Damaged by Thermal Stress and Corrosion: Nonprorated for five (5) years from date of Substantial Completion.

(3) Flue Gas Corrosion and/or defective material or workmanship: Five (5) years from the date of shipment from the factory. The manufacturer will repair, replace, exchange or credit at the option of PGCPS.

Part 2 - Products

I. Condensing Boilers

A. Factory-fabricated, -assembled, and -tested, condensing boiler with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket; flue-gas vent; combustion-air intake connections; water supply, return, and condensate drain connections; and controls. Water heating service only. Acceptable manufacturers include:

1. Cleaver-Brooks
2. Fulton
3. Hydrotherm/KN
4. Weil-McLain.

B. Boiler burner package, including accessories, controls and boiler trim, all factory mounted and wired, shall be approved as a unit by Underwriters Laboratories, Inc., and furnished with a guarantee that it will meet all state and EPA air pollution control regulations. Boiler shall develop full IBR gross output capacity at 100 percent firing rate.

C. Complete boiler assembly shall be hydrostatically pressure tested after erection in accordance with Section IV of the ANSI/ASME Boiler and Pressure Vessel Code.

D. Combustion Chamber: Stainless steel, sealed.

E. Blower: Centrifugal fan to operate during each burner firing sequence and to prepurge and post-purge the combustion chamber.

1. Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
   a) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

F. Gas Train: Combination gas valve with manual shutoff and pressure regulator.

G. Ignition: Silicone carbide hot-surface ignition that includes flame safety supervision and 100 percent main-valve shutoff.

H. Integral Circulator: Cast-iron body and stainless-steel impeller sized for minimum flow required in heat exchanger.

II. Boiler Shell and Insulation

A. The boiler shell shall be constructed in accordance with ANSI/ASME Boiler and Pressure Vessel Code and inspected prior to shipment. Submit ASME Boiler Inspection Report for approval.

B. Casing

1. Jacket: Sheet metal, with snap-in or interlocking closures.
2. Control Compartment Enclosures: NEMA 250, Type 1A.
3. Finish: Powder-coated protective finish.
4. Insulation: Minimum 4-inch (100-mm-) thick, mineral-fiber insulation surrounding the heat exchanger.
5. Combustion-Air Connections: Inlet and vent duct collars.
6. Mounting base to secure boiler.
7. Seismic Fabrication Requirements: Fabricate mounting base and attachment to boiler pressure vessel, accessories, and components with reinforcement strong enough to withstand seismic forces when mounting base is anchored to building structure.

III. Boiler Trim

A. The boiler trim for each boiler shall include the following:

1. Include devices sized to comply with ANSI B31.1, "Power Piping.
2. Combination high-limit and low-limit water temperature cut-off control.
3. Pressure and Temperature Gage: Minimum 3-1/2-inch- (89-mm-) diameter, combination water-pressure and -temperature gage. Gages shall have operating-pressure and -temperature ranges so normal operating range is about 50 percent of full range.
4. Water relief valve (ASME-rated), set at pressure as needed by code.
5. Approved low water cut-off switch.
6. 1 inch taps for water treatment and water sampling lines.
7. Safety Relief Valve: ASME rated.
8. Boiler Air Vent: Automatic.
9. Drain valve with hose connection.

10. All conduit and wiring of boiler controls. (Refer to Section 15900 for controls details)
11. Control circuit shall interconnect with the combustion safeguard and limit control circuits governing burner operation. To provide fixed damper opening during purge, constant outlet pressure during firing, and closed damper after boiler shutdown, a selector switch shall provide a means of manually positioning the damper for test purposes. However, the burner shall shut down when the switch is moved from automatic.
    a) Actuator shall be self-locking on power failure and shall be equipped with integral brake for close position controls. The mechanisms shall be totally enclosed in a dust-tight cabinet.
    b) Limit and purge position signal switches shall be an integral part of the damper operator. All necessary linkages, including adjustable clevises, pipe adaptors and damper lever arms, shall be designed for the particular use of the equipment.
    c) Combination Burner

B. Provide a flame-retention forced-draft type combination gas and/or oil burner that shall not exceed manufacturer's recommended distance from the front of the boiler to the end of the burner.
C. Oil and gas fuel trains shall include all safety devices required for Factory Mutual Global (FMG) approval with auxiliary dry contacts as indicated.
D. Provide a factory-wired burner control panel integral with the burner assembly. Panel shall include switches, indicating lights, step-down control transformer with fuse, and devices to effectively operate the boiler/burner system in combination with a lead-lag controller.
E. Provide one (1) set of normally-open auxiliary contacts for remote alarm indication.
F. Provide contacts for emergency boiler cut-off switch.
G. Control panel shall include an electronic combustion safeguard burner primary control, with pre-purge and post-purge programming, and ultra-violet-sensitive electronic flame detector and motor starter relay.
H. Control panel shall also include a manual fuel transfer switch permitting manual fuel changeover.
I. Provide a circuit breaker to deenergize all power to the boiler and control circuits.
J. Graphic Burner Display:

1. Provide, as part of the control cabinet, a multi-color graphic display with integral annunciator status lights.
2. System shall allow the operator a view of the operational status on a lighted graphic display of burner operation.
3. Graphic display shall be mounted on an easy access panel door with quick disconnect device to enable the operator to disconnect system or remove access door while maintaining annunciator in full operation.
4. The following points shall be annunciated on the graphic display:
   a) Power On: Green.
   b) Limits Closed: Green.
   c) Flame Failure: Red.
   d) Main Gas: Blue.
   e) Main Oil: Amber.
   f) High Fire Oil Control: Amber.
   g) High Fire Air Control: Amber.

IV. Lead-Lag Controller

A. Provide a lead-lag sequence controller to control the operation of boilers with modulating combustion control.

B. Lead-lag controller shall be Cleveland Controls, Inc. Master Sequence Programmer Series "C" or approved equal.

Part 3 - Execution

I. Field Quality Control

A. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Perform installation and startup checks according to manufacturer's written instructions.
2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
    a) Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level, and water temperature.
    b) Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Remove and replace malfunctioning units and retest as specified above.

D. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

E. Engage a factory-authorized service representative to train PGCPS maintenance personnel to adjust, operate, and maintain boilers.

II. Installation

A. Mount boiler(s) level on concrete foundations as required by manufacturer and/or structural engineer, if required.

B. Vibration Isolation: Elastomeric mounts with a minimum static deflection of 0.25 inch (6.35 mm) or as approved by PGCPS.

C. Install the work in accordance with manufacturer's written instructions, approved submittals, and in compliance with all referenced codes and ordinances.

D. Connect all piping to boiler(s) in accordance with the Specification Sections referenced under Article, Related Work Specified Elsewhere (Non-inclusive), and as indicated on the Drawings.

E. Provide field control wiring of boiler, boiler control panel, boiler annunciator, multiple boiler control panel, automatic damper blade end switches, and their associated sensors in accordance with the requirements of Division 16.

F. Equipment dimensions shall be such that it will adequately fit into the mechanical space and shall, when installed, fit within the allocated space indicated on Drawings.

G. All boiler, burner and auxiliary components shall be delivered, unloaded and stored in an area adjacent to the erection location as directed by Owner.

H. Boiler/burner components shall be assembled by mechanics experienced with boiler erection. The hydrostatic test of the pressure parts of the boiler shall be performed before the insulation and casing are installed. The test shall be witnessed by the Owner's Representative, the Design Professional and the delegated boiler inspector.

I. After the insulation and casing have been installed, the burner shall be mounted to the boiler, and all wiring and controls shall be wired and tested.

J. Lead-lag controller and other auxiliaries that are shipped loose shall be installed and wired in accordance with the Contract Documents after the Mechanical Installer has completed all of the piping and power wiring work.

K. Erection of boiler, burner and controls shall be coordinated with PGCPS and the Mechanical Installer.

L. Startup and one-year service shall be included for each boiler.

M. Provide an engraved nameplate permanently affixed to the front of the control cabinet (inside of cabinet for outdoor locations) with the following information:

UNIT #	*(unit number)*
INSTALLED BY:	*(contracting company's name)*
WARRANTY EXPIRES:	*(month/day/year)*
COMPRESSOR WARRANTY EXPIRES:	*(month/day/year)*

III. Manufacturer's Services

A. After the boiler, piping and electrical systems have been completed by the Mechanical Installer, each boiler shall be operated by the boiler manufacturer under actual operating conditions to demonstrate to PGCPS and the Design Professional that they meet the design requirements.

B. Operation and test shall be no less than twenty four (24) hours for each boiler.

END OF SECTION

Part 1 - General

I. General

A. The Bidding and Contract Requirements, Division 1 - General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope

A. The work covered under this section shall include Factory-packaged sectional cast iron hot water boiler(s), including boiler casing and insulation, boiler trim, combination oil and gas burner, oil and gas fuel trains, burner and flame failure control system, draft control damper, lead-lag controller for boilers and control panel as specified herein and scheduled in this Section.

III. Quality Assurance

A. Referenced codes and standards include:

1. American Boiler Manufacturers Association (ABMA)
2. American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
    a) CSD-1: Controls and Safety Devices for Automatically-Fired Boilers; Boiler and Pressure Vessel Code, Section IV: Heating Boilers
3. ASTM International (ASTM)
    a) D 396: Specification for Fuel Oils
4. Factory Mutual Global System (FMG) Approval Guide
5. Hydronics Institute (HI)
    a) I-B-R Cast Iron Boiler Ratings
    b) S-B-R Steel Boiler Ratings
6. General Electric Global Asset Protection (GE GAP) Approval Guide
7. National Fire Protection Association (NFPA)
    a) 85: Boiler and Combustion Hazards Code
8. Underwriters Laboratories, Inc. (UL)
9. Prince George's County Building Codes
10. International Mechanical Code

IV. Submittals

A. Provide shop drawings including predicted performance data, design, fabrication and installation details. Include piping and wiring diagrams, and shipping and operating weights.

B. Provide minimum 1-year warranty, required product certifications and operating permits for all equipment.

Part 2 - Products

I. Cast Iron Boilers

A. Hot water boiler shall be constructed of cast iron sections with draw rods, packaged and designed for a flame-retention type combination high-pressure No. 2 oil burner and power gas burner, and factory-painted casings. Acceptable manufacturers include:

1. Burnham
2. Hurst
3. Smith.

B. Boiler burner package, including accessories, controls and boiler trim, all factory mounted and wired, shall be approved as a unit by Underwriters Laboratories, Inc., and furnished with a guarantee that it will meet all state and EPA air pollution control regulations. Boiler shall develop full IBR gross output capacity at 100 percent firing rate.

C. Complete boiler assembly shall be hydrostatically pressure tested after erection in accordance with Section IV of the ANSI/ASME Boiler and Pressure Vessel Code.

D. Combustion box shall be surrounded with water that is constantly circulated.

II. Boiler Shell and Insulation

A. The boiler shell shall be constructed in accordance with ANSI/ASME Boiler and Pressure Vessel Code and inspected prior to shipment. Submit ASME Boiler Inspection Report for approval.

B. Boiler casing shall be completely insulated with 2 inch thick, 1.6 pcf fiberglass blanket under sectional performed sheet metal lagging that can be readily removed and easily reinstalled. Casing shall have a baked enamel finish.

III. Boiler Trim

A. The boiler trim for each boiler shall include the following:

1. Combination high-limit and low-limit water temperature cut-off control.
2. Pressure gage, 6 inch minimum diameter.
3. Temperature gage, 5 inch minimum diameter.
4. Temperature control (for regulation of burner operation).

5. Water relief valve (ASME-rated), set at pressure as needed by code.
6. Approved low water cut-off switch.
7. 1 inch taps for water treatment and water sampling lines.
8. Built-in air eliminator.
9. Drain valve with hose connection.
10. All conduit and wiring of boiler controls.
11. Control circuit shall interconnect with the combustion safeguard and limit control circuits governing burner operation. To provide fixed damper opening during purge, constant outlet pressure during firing, and closed damper after boiler shutdown, a selector switch shall provide a means of manually positioning the damper for test purposes. However, the burner shall shut down when the switch is moved from automatic.
    a) Actuator shall be self-locking on power failure and shall be equipped with integral brake for close position controls. The mechanisms shall be totally enclosed in a dust-tight cabinet.
    b) Limit and purge position signal switches shall be an integral part of the damper operator. All necessary linkages, including adjustable clevises, pipe adaptors and damper lever arms, shall be designed for the particular use of the equipment.
    c) Combination Burner

B. Provide a flame-retention forced-draft type combination oil/gas burner [that shall not exceed manufacturer's recommended distance from the front of the boiler to the end of the burner.
C. Burner shall be capable of firing either No. 2 fuel oil or natural gas Combination oil/gas burner shall be arranged for full modulation with pre-purge, low fire start, high fire run and post-purge.
D. Oil and gas fuel trains shall include all safety devices required for Factory Mutual Global (FMG) approval with auxiliary dry contacts as indicated.
E. Provide a factory-wired burner control panel integral with the burner assembly. Panel shall include switches, indicating lights, step-down control transformer with fuse, and devices to effectively operate the boiler/burner system in combination with a lead-lag controller.
F. Provide one (1) set of normally-open auxiliary contacts for remote alarm indication.
G. Provide contacts for emergency boiler cut-off switch.

H. Control panel shall include an electronic combustion safeguard burner primary control, with pre-purge and post-purge programming, and ultra-violet-sensitive electronic flame detector and motor starter relay.

I. Control panel shall also include a manual fuel transfer switch permitting manual fuel changeover.

J. Provide a circuit breaker to deenergize all power to the boiler and control circuits.

K. Graphic Burner Display:

1. Provide, as part of the control cabinet, a multi-color graphic display with integral annunciator status lights.
2. System shall allow the operator a view of the operational status on a lighted graphic display of burner operation.
3. Graphic display shall be mounted on an easy access panel door with quick disconnect device to enable the operator to disconnect system or remove access door while maintaining annunciator in full operation.
4. The following points shall be annunciated on the graphic display:
   a) Power On: Green.
   b) Limits Closed: Green.
   c) Flame Failure: Red.
   d) Main Gas: Blue.
   e) Main Oil: Amber.
   f) High Fire Oil Control: Amber.
   g) High Fire Air Control: Amber.

IV. Lead-Lag Controller

A. Provide a lead-lag sequence controller to control the operation of boilers with modulating combustion control.

B. Lead-lag controller shall be Cleveland Controls, Inc. Master Sequence Programmer Series "C" or approved equal.

Part 3 - Execution

I. Installation

A. Mount boiler(s) on concrete foundations as required by manufacturer and/or structural engineer.

B. Install the work in accordance with manufacturer's written instructions, approved submittals, and in compliance with all referenced codes and ordinances.

C. Connect all piping to boiler(s) in accordance with the Specification Sections referenced under Article, Related Work Specified Elsewhere (Non-inclusive), and as indicated on the Drawings.

D. Provide field control wiring of boiler, boiler control panel, boiler annunciator, multiple boiler control panel, automatic damper blade end switches, and their associated sensors in accordance with the requirements of Division 16.

E. Equipment dimensions shall be such that it will adequately fit into the mechanical space and shall, when installed, fit within the allocated space indicated on Drawings.

F. All boiler, burner and auxiliary components shall be delivered, unloaded and stored in an area adjacent to the erection location as directed by Owner.

G. Boiler/burner components shall be assembled by mechanics experienced with boiler erection. The hydrostatic test of the pressure parts of the boiler shall be performed before the insulation and casing are installed. The test shall be witnessed by the Owner's Representative, the Design Professional and the delegated boiler inspector.

H. After the insulation and casing have been installed, the burner shall be mounted to the boiler, and all wiring and controls shall be wired and tested.

I. Lead-lag controller and other auxiliaries that are shipped loose shall be installed and wired in accordance with the Contract Documents after the Mechanical Installer has completed all of the piping and power wiring work.

J. Erection of boiler, burner and controls shall be coordinated with PGCPS and the Mechanical Installer.

K. Startup and one-year service shall be included for each boiler.

L. Provide an engraved nameplate permanently affixed to the front of the control cabinet (inside of cabinet for outdoor locations) with the following information:

UNIT #	*(unit number)*

INSTALLED BY:	*(contracting company's name)*
WARRANTY EXPIRES:	*(month/day/year)*
COMPRESSOR WARRANTY EXPIRES:	*(month/day/year)*

II. Manufacturer's Services

A. After the boiler, piping and electrical systems have been completed by the Mechanical Installer, each boiler shall be operated by the boiler manufacturer under actual operating conditions to demonstrate to PGCPS and the Design Professional that they meet the design requirements.

B. Operation and test shall be no less than twenty four (24) hours for each boiler.

END OF SECTION

Part 1 - General

I. General

A. The Bidding and Contract Requirements, Division 1 - General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope

A. The work covered under this section shall include Factory-packaged fire tube hot water boilers, including boiler shell and insulation, tubes, tube sheets, combination oil and gas burner, intermittent gas pilot, boiler trim, oil, gas and gas pilot fuel trains, combustion control burner and flame failure control system, control panel, boiler draft and outlet damper control, and lead/lag controller for control of boilers as specified herein.

III. Quality Assurance

A. Referenced codes and standards include:

1. American Boiler Manufacturers Association (ABMA)
2. American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
    a) CSD-1: Controls and Safety Devices for Automatically-Fired Boilers; Boiler and Pressure Vessel Code, Section IV: Heating Boilers
3. ASTM International (ASTM)
    a) D 396: Specification for Fuel Oils
4. Factory Mutual Global System (FMG) Approval Guide
5. Hydronics Institute (HI)
    a) I-B-R Cast Iron Boiler Ratings
    b) S-B-R Steel Boiler Ratings
6. General Electric Global Asset Protection (GE GAP) Approval Guide
7. National Fire Protection Association (NFPA)
    a) 85: Boiler and Combustion Hazards Code
8. Underwriters Laboratories, Inc. (UL)
9. Prince George's County Building Codes
10. International Mechanical Code

IV. Submittals

A. Provide shop drawings including predicted performance data, design, fabrication and installation details. Include piping and wiring diagrams, and shipping and operating weights.

B. Provide warranty, required product certifications and operating permits for all equipment.

Part 2 - Products

I. Fire Tube Hot Water Boilers

A. The hot water boiler shall be a factory-packaged 3-pass horizontal fire tube, forced-draft, combination oil and gas fired unit mounted on a structural steel frame, factory wired and tested, and factory painted. The complete package, including accessories, boiler trim and intermittent gas pilot, shall be approved as a unit by Underwriters Laboratories, Inc. and furnished with a guarantee that it will meet all state, OSHA and EPA air pollution control requirements. Acceptable manufacturers include:

1. Burnham
2. Hurst
3. Smith.

B. Unit shall have voltage as required, 3 phase/60 Hz, single-source power supply with fused disconnect switch. Provide any necessary stepdown transformers with package.

C. The boiler shall have a minimum fireside heating surface ratio of 5 square feet per rated boiler horsepower.

D. The boiler tubes shall have an outside diameter of no less than 2 1/2 inches.

E. The boiler shall have a factory-mounted forced-draft burner and burner controls, including a completely factory wired and tested boiler control panel. The burner shall be a flame-retention type combination oil/gas burner, low NOx type with the required equipment to lower NOx emissions to 60 ppm at 3 percent oxygen in the flue gas when firing on natural gas.

F. The burner system shall be integrated with the front head of the boiler, and shall have a combination forced air type burner for oil firing. and an annular port flame retention type burner for gas firing. The burner shall be approved for operation burning either Commercial No. 2 fuel oil meeting ASTM D 396, or natural, manufactured or mixed gas. The oil pumps shall have psi as needed.

G. The gas system shall include a primary motor-operated gas shut-off valve with spring return. The gas train, controls and regulator shall meet Factory Mutual Global (FMG) Standards.

H. The burner shall have an integral forced-draft fan with inlet louvered dampers connected via a jackshaft and linkage to a cam-operated oil metering valve, so that air and oil supply will synchronize through the modulating firing range.

I. The burner shall have an intermittent fully automatic gas-electric ignition, including gas regulator and gas solenoid valve.

J. The front and rear tube sheets, and all flues shall be fully accessible for inspection and cleaning, including front and rear observation ports for inspection of flame conditions.

K. The boilers shall be factory tested under full-load firing conditions with the specified fuel and a copy of the actual performance test shall be submitted to the Owner.

II. Boiler Shell and Insulation

A. The boiler shell shall be constructed in accordance with ANSI/ASME Boiler and Pressure Vessel Code and inspected prior to shipment.

B. The boiler insulation shall consist of a 2 inch thick insulation blanket under sectional, preformed sheet metal lagging that can be easily removed and reinstalled.

III. Boiler Trim

A. The boiler trim for each boiler shall include the following:

1. Low water-level cut-off wired into the burner control circuit with a manual reset device.
2. Water pressure gage (8 inches).
3. Water thermometers (6 inch) industrial-rated dial type) on inlet (0 to 400 degrees F) and outlet (0 to 400 degrees F).
4. Excess oxygen analyzer (optional). Provide one (1) portable unit per boiler room.
5. Excess oxygen controller (optional).
6. Relief valves selected in accordance with ASME code requirements, set pressure at as needed.
7. 1 inch taps for water treatment, chemical injection and water sampling lines.
8. Bottom drain valves.
9. Automatic air eliminator valves on boiler shell.
10. Stack thermometer (6 inch) industrial-rated mounted in boiler combustion gas outlet.
11. Check valve and shut-off valve for boiler fill.

IV. Oil Burner and Flame Failure Control System

A. The program relay shall control ignition, starting and stopping of the burner.

B. The control system shall shut down the burner in the event of ignition, pilot, or flame failure.

C. The burner shall always return to low-fire position for ignition.

D. Provide the control system with both a pre-combustion purge and a post-combustion purge.

V. Gas Burner and Flame Failure Control System

A. The gas piping system motor-operated shut-off valve shall control the stopping and starting of the gas burner.

B. Provide the control system with both a pre-combustion purge and a post-combustion purge.

C. The gas shut-off valve shall automatically fail closed in the event of power failure, flame failure, or a low water-level condition.

D. Provide lubricated plug-type valves ahead of the motorized valve for manual shut-off, and the gas pilot, separately.

E. The gas pilot shall be equipped with automatic electric ignition (with detector controlling gas valve opening only when pilot flame has been established).

VI. Burner Blower Controls

A. The burner blower shall be interlocked to prevent burner operation without required mechanical draft.

B. The burner blower shall have an automatic burner timer delay to allow the fan to purge boiler passes of combustion gases after flame failure or other burner malfunction.

C. The control panel shall be completely factory-wired. Controls shall includeThe control panel shall contain burner controls, including:

1. Burner relay.
2. Blower motor starter.
3. Control switches.
4. Status indicating lights for:
    a) Power On.
    b) Purge Complete.
    c) Flame Failure.
    d) Low Water Level.
    e) Fuel Valve On.
    f) Load Demand.
    g) Remote Start/Stop.

D. Provide a three-pole breaker as required by code to deenergize all power to boiler power and control circuits.

E. Provide a modulating controller to permit automatic or manual continuous firing at any rate between low fire and maximum burner rating.

F. Provide a fuel selector switch and interlocks to prevent simultaneous firing of different fuels.

VII. Boiler Annunciator

VIII. Power Flame Burner will supply as need.

A. Alarm:

a) Low Water Level.

b) High Water Pressure.

c) High Water Temperature.

d) .

e) Low Oil Pressure.

f) Low Gas Pressure.

g)

2. Status and Alarm:

a) Power Off.

b) Pilot Flame Off.

c) Main Flame Off.

d) Fan Off.

e) Air Compressor Off.

f) Spare.

g) Spare.

B. The annunciator shall be factory wired with UL label. Annunciator shall be powered from the boiler control panel.

C. Provide one common alarm contact for remote alarm to the DDC System. Conduit and wiring between the annunciator and the remote DDC System panel will be provided by others under Division 16.

D. Provide automatic resets for alarms due to power failures.

E. Provide manual "acknowledge" reset for all audible alarm points.

F. Provide one (1) set of dry contacts for remote indication of boiler status.

G. Approved Manufacturers: The following annunciator manufacturers and products are acceptable. No substitutions.

1. Fireye Model E110/EP160/ED510.

IX. Multiple Boiler Control Panel

A. Provide a central control panel common to all boilers.
B. Provide a multiple boiler control package using a sequence controller for the cycling and firing rate for boilers, as a function of water temperature in the common boiler outlet header.
C. Provide a packaged NEMA control cabinet, factory wired, piped and tested. Wiring to and from panel will be provided by others under Division 16.
D. Provide a sequence controller to permit automatic sequencing of the multiple boilers. The sequence shall be modified from the panel by the operator.
E. The master sequence controller shall start boilers in sequence, one at a time, in response to the hot water outlet header temperature. The control sensing range shall be 180 to 250 degrees F.
F. Approved Manufacturers: The following sequence controller Power Flame.The sequence controller shall permit on-off or modulating operation, and out-of-service status.
G. The sequence controller shall turn off boilers in the opposite sequence to that of starting.
    1. Leaving water temperature.

Part 3 - Execution

I. Installation
A. Mount boiler(s) on concrete foundations as required by manufacturer and/or structural engineer.
B. Install the work in accordance with manufacturer's written instructions, approved submittals, and in compliance with all referenced codes and ordinances.
C. Connect all piping to boiler(s) in accordance with the Specification Sections referenced under Article, Related Work Specified Elsewhere (Non-inclusive), and as indicated on the Drawings.
D. Provide field control wiring of boiler, boiler control panel, boiler annunciator, multiple boiler control panel, automatic damper blade end switches, and their associated sensors in accordance with the requirements of Division 16.
E. Provide an engraved nameplate permanently affixed to the front of the control cabinet (inside of cabinet for outdoor locations) with the following information:

UNIT #	*(unit number)*
INSTALLED BY:	*(contracting company's name)*
WARRANTY EXPIRES:	*(month/day/year)*
COMPRESSOR WARRANTY EXPIRES:	*(month/day/year)*

II. Manufacturer's Services

A. Provide manufacturer's startup service, field testing, and instruction to PGCPS Building Services on operation and maintenance of boiler(s) for a minimum of for 2 years each boiler.

B. Operation and test shall be no less than twenty four (24) hours for each boiler.

END OF SECTION

Part 1 - General

I. General

A. The Bidding and Contract Requirements, Division 1 - General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope

A. The work covered under this section shall include packaged, factory-fabricated and -assembled, combination gas- and oil-fired, fire tube boilers, trim, and accessories for generating steam.

III. Quality Assurance

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of fire-tube boilers and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

B. Ancillary electrical components shall be Underwriters Laboratories (UL) listed and labeled and in accordance with national Fire Protection Association (NFPA) code 70 "National Electrical Code".

C. ASME Compliance: Fabricate and label fire-tube boilers to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

D. ASHRAE/IESNA 90.1 Compliance: Fire-tube boilers shall have minimum efficiency according to Table 10-8.

E. UL Compliance: Test fire-tube boilers to comply with UL 726, "Oil-Fired Boiler Assemblies."

F. UL Compliance: Test fire-tube boilers to comply with UL 795, "Commercial-Industrial Gas Heating Equipment."

G. Comply with Federal, State, and Local Codes and regulations.

H. Control devices and control sequences: in accordance with requirements of ASME, CSD-1, Industrial Risk Insurers (IRI) and factory Mutual Insurance (FM).

I. Installation standards: Oil-fired burners shall be in accordance with National Fire Protection Association (NFPA) Standard 31 "Standard for the Installation of Oil Burning Equipment".

J. Installation standards: Gas-fired burners shall be in accordance with National Fire Protection Association (FNPA) Code 54 “National Fuel Gas Code”.

IV. Submittals

A. Provide shop drawings on all boilers as described in Section 15010 - 1.04.

B. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.

C. Shop Drawings: For boilers, boiler trim, and accessories. Include plans, elevations, sections, details, and attachments to other Work. Shop Drawings shall be signed and sealed by a qualified professional engineer.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
3. Wiring Diagrams: Detail power, signal, and control wiring.

D. Source quality-control test reports.

E. ASME Stamp Certification and Report: Submit "H2" stamp certificate of authorization, as required by authorities having jurisdiction, and document hydrostatic testing of piping external to boiler.

F. Startup service reports.

G. Operation and Maintenance Data: For fire-tube boilers to include in emergency, operation, and maintenance manuals.

H. Warranties: Special warranties specified in this Section.

V. Coordination

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

VI. Warranty

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace front and rear door refractories and heat exchangers of fire-tube boilers that fail in materials or workmanship within specified warranty period.

1. Fire Tube Boilers: Refractory in front and rear doors, 10 years from date of startup by factory-authorized personnel.

Part 2 - Products

I. Manufacturers

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

II. Fire Tube Boilers

A. Manufacturers:
   1. Superior Boilers
   2. Burnham
   3. Hurst

B. Description: Factory-fabricated, -assembled, and -tested fire-tube boilers with heat exchanger sealed pressure-tight, built on a steel base; including insulated jacket, flue-gas vent, water supply and return connections, and controls.

C. Fabricate base and attachment to pressure vessel with reinforcement strong enough to resist boiler movement during a seismic event when boiler base is anchored to building structure.

D. Pressure Vessel Design: Straight steel tubes welded into steel headers. Three passes with wet-back design. The ratings shall be based on no less than five square feet of heating surface (waterside) per boiler horsepower. Include the following features and accessories:
   1. Tube Size and Thickness: Minimum NPS 2, minimum 0.105 inch thick.
   2. Brass washout plugs.
   3. Steel turbulators.
   4. Lifting lugs on top of boiler.
   5. Minimum NPS 1 hose-end drain valves at shell low point.
   6. Accessible drain and blowdown tappings, both high and low, for surface and mud removal.
   7. Tappings for steam supply, makeup, level controls, and chemical treatment.
   8. Tappings or flanges for supply- and return-water piping.
   9. Built-in air separator.

E. Combustion Chamber: Welded steel, waterwall and -floor design or water-leg design with refractory insulation poured in the floor. Flame observation port.

F. Casing:
   1. Insulation: Minimum 2-inch- thick mineral-fiber insulation surrounding the boiler shell.
   2. Insulated removable smoke boxes and reversing chamber cover.
   3. Jacket: Sheet metal, with screw-fastened closures and baked-enamel or powder-coated protective finish.
   4. Control Compartment Enclosure: NEMA 250, Type 1A.

G. Barometric Damper: Galvanized-steel assembly with flue-gas thermometer having a minimum 3-1/2-inch- diameter dial.

III. Combination Gas And Oil Burners

A. Burner: Welded construction with multivane, stainless-steel, flame-retention diffuser for fuel oil and natural gas. Mount burner on hinged access door to permit access to combustion chamber.

B. Blower: Forward-curved, centrifugal fan integral to burner, directly driven by motor; with adjustable, dual-blade damper assembly and locking quadrant to set air-fuel ratio.
   1. Refer to Division 15 Section "Motors" for general requirements.
   2. RPM: 3450.

C. Oil Supply: Control devices and low-high-lo control sequence shall comply with requirements in FMG, ASME CSD-1, and UL.
   1. Two-stage, gear-type oil pump shall be capable of producing 300-psig discharge pressure and 15-in. Hg vacuum. Include suction-line, manual, gate-type shutoff valve; removable-mesh-type oil strainer; 0- to 30-in. Hg vacuum; 0- to 30-psig vacuum-pressure gage; 0- to 300-psig oil-nozzle pressure gage; and nozzle-line, solenoid-safety-shutoff oil valve.

D. Gas Train: Control devices and low-high-low control sequence shall comply with requirements in ASME CSD-1 and UL.

E. Gas Pilot: electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff with electronic supervision of burner flame.

F. Oil Pilot: electric-spark pilot ignition with 100 percent main-valve and pilot-safety shutoff solenoid with cadmium sulfide or ultraviolet scanner flame-safety control.

IV. Steam Boiler Trim

A. Include devices sized to comply with ANSI B31.1, "Power Piping, ANSI B31.9, "Building Services Piping."

B. Pressure Controllers: Manual reset high limit pressure limit, operating pressure control, modulating pressure control when applicable.

C. McDonnell Miller combination pump controls/water columns with low water cut off, tri-cocks and sight glasses. Water columns above six feet high shall have chain-operated tri-cocks.

D. McDonnell Miller # 51 automatic water feeder with secondary low water cutoff.

E. Safety Relief Valve:

1. Size and Capacity: As required for equipment according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
   a) Pressure Setting: 15 psig.
2. Bronze Safety Valves: Class 250, forged copper-alloy disc; fully enclosed steel spring with adjustable pressure range and positive shutoff; factory set and sealed.
   a) Drip-Pan Elbow: Cast iron and having threaded inlet and outlet with threads complying with ASME B1.20.1.

F. Pressure Gage: Minimum 3-1/2-inch diameter, 0- to 30-psig range.

G. Water Column: Minimum 12-inch glass gage with shutoff cocks.

H. Drain Valves: Minimum NPS 3/4 or nozzle size with hose-end connection.

I. Boiler mud legs will have blow down valves on the front and rear (4) at each corner. The valves will be full size of the boiler tapping and piped to floor drain. The sides of each mud leg corner (4) will have installed nipples and caps for ease in cleaning and inspections. Blowdown valves shall be combination of slow and quick acting as required by ANSI B31.1.

J. Stop Valves: Boiler inlets and outlets, except safety relief valves or preheater inlet and outlet, shall be equipped with stop valve in an accessible location as near as practical to boiler nozzle and same size or larger than nozzle. Valves larger than NPS 2 shall have rising stem.

K. Stop-Check Valves: Furnish stop-check valve and stop valve for field installation at boiler outlet with free-blow drain valve for field installation between the two valves and visible when operating stop-check valve.

L. 5" stack thermometers located at the rear of the boiler.

M. 6" diameter steam pressure gauge.

N. A rear flue access plug shall be included with the boilers to allow access to the boiler fire box, for inspection and cleaning, without removing the burner.

O. Factory installed brass screw piping is to be used on all water columns and water feeders. These will be equipped with cross tees to permit visual inspection of the piping interior.

P. Two lifting loops on top of boiler.

Q. On low-high or modulating boilers, a low fire hold will be installed to provide automatic warming of cold boiler when it is put on line.

R. Remote pump mounted at burner to permit change over from gas to oil without having to install a coupling or make mechanical adjustments.

S. A cross will be installed above the normal water line with a steam trap. This will be piped to the boiler feed tank to maintain water level in lag boiler, preventing flooding.

V. Burner Controls

A. Burner Control Panel

1. The burner control panel (NEMA 12) will be equipped with annunciator lamps to indicate the status of the following burner circuits:
   a) Power on
   b) Call for heat
   c) Pilot on
   d) Main fuel valve
   e) Low water
   f) Alarm
2. The alarm lights will be located on the top, or front, of the cabinet.
3. The panel shall contain an alarm horn, with silencing switch, which will sound when the boiler goes into flame failure or a low water condition.
4. The control panel will also include a burner on/off switch, a manual/automatic switch, and a manual firing rate potentiometer.

B. A secondary alarm relay will be installed in each control panel. This relay will be wired in series so that both boilers must be in safety before an alarm relay signal is generated to the Board's security office.

C. A night setback switch will be installed in the control panel and wired to an aquastat in the boiler to maintain 180 degrees F in the boiler when switched to the night position. When switched to the day position the pressure control will operate at the set pressure. The switch will be clearly labeled "Day/Night."

D. A relay will be provided to bypass the lead/lag system, based on an input from an indoor temperature sensor, should the indoor temperature drop below set point.

E. All of the above lights, alarms, and switches will be factory wired and appear on the wiring diagram submitted prior to ordering the equipment, with the same drawing laminated and install on the inside of the burner panel.

F. All control components shall be mounted within integral control panels, one for each burner. The panel shall allow full access to the internal components.

VI. Flame Safeguard Control

A. The flame safeguard control shall be installed by the contractor and be a Fireye Flame-Monitor Model E-110, microprocessor based flame safety control to consisting of the following:

1. EB 700 chassis (one per boiler)
2. ED 510 display module (one per boiler)
3. EC 600 dust cover (one per boiler)
4. EIRI Infrared amplifier (one per boiler)

B. Items above must be installed and wired at the factory and tested by the boiler manufacturer.

C. All devices, wiring diagrams, switches and controls, including those within control cabinets, shall be UL listed and clearly labeled.

D. Ultraviolet flame detection will not be acceptable.

E. Emergency Shutoff Switches

1. The contractor will install at least 2 emergency shut off switch(s) as required by code authorities. All electrical devices and equipment required to enable the operation of the switch(s) shall be provided and installed by the contractor. The switch shall shut down all power to the burners, oil pumps and gas valves. It shall be of design that does not require manual resetting in the event of a power failure. The locations of the switches shall be approved by the Owner and the applicable regulatory agencies. A vandalism resistant pre-alarm cover acceptable to the Board shall protect such switches. Affix proper signage to identify said switches.

F. Description: To maintain safe operating conditions, burner safety controls limit the operation of burner. Microprocessor-based control system integrates safety and operating controls.

1. High Cutoff: Manual reset stops burner if operating conditions rise above maximum boiler design pressure.
2. Low-Water Cutoff Switch: Electronic probe shall prevent burner operation on low water. Cutoff switch shall be manual-reset type.

G. Alarm Bell: Factory mounted on control panel with silence switch; shall sound alarm for above conditions.

VII. Source Quality Control

A. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code: Section I, for high-pressure boilers and Section IV, for low-pressure boilers.

B. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.

C. Allow Owner access to source quality-control testing of fire-tube boilers. Notify Engineer 14 days in advance of testing.

Part 3 - Execution

I. Examination

A. Before boiler installation, examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting boiler performance, maintenance, and operations.

1. Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.

B. Examine mechanical spaces for suitable conditions where boilers will be installed. Proceed with installation only after unsatisfactory conditions have been corrected.

II. Boiler Installation

A. Install boilers level on concrete base. Concrete base is specified in Division 15 Section "Basic Mechanical Materials and Methods," and concrete materials and installation requirements are specified in Division 3.

B. Concrete Bases: Anchor boilers to concrete base.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Cast-in-place concrete materials and placement requirements are specified in Division 3.

C. Install gas-fired boilers according to NFPA 54.

D. Install oil-fired boilers according to NFPA 31.

E. Assemble and install boiler trim.

F. Install electrical devices furnished with boiler but not specified to be factory mounted.

III. Connections

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect gas piping full size to boiler gas-train inlet with union.

C. Connect oil piping full size to burner inlet with shutoff valve and union.

D. Connect hot-water piping to supply- and return-boiler tappings with shutoff valve and union or flange at each connection.

E. Connect steam and condensate piping to supply-, return-, and blowdown-boiler tappings with shutoff valve and union or flange at each connection.

F. Install piping from safety relief valves to nearest floor drain.

G. Install piping from safety valves to drip-pan elbow and to nearest floor drain.

H. Connect breeching full size to boiler outlet. Refer to Division 15 Section "Breechings, Chimneys, and Stacks" for venting materials.

I. Install flue-gas recirculation duct from vent to burner. Refer to Division 15 Section "Breechings, Chimneys, and Stacks" for recirculation duct materials.

J. Install piping adjacent to boiler to allow service and maintenance.

K. Ground equipment according to Division 16 Section "Grounding and Bonding."

L. Connect wiring according to Division 16 Section "Conductors and Cables."

M. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

IV. Startup Service

A. Engage a factory-authorized service representative to test, inspect, and adjust boiler components and equipment installation and to perform startup service.

B. Perform installation and startup checks according to manufacturer's written instructions.

C. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.

D. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.

E. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

F. Adjust initial temperature set points.

G. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

H. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose, without additional cost.

I. Prepare written report that documents testing procedures and results.

J. Provide an engraved nameplate permanently affixed to the front of the control cabinet (inside of cabinet for outdoor locations) with the following information:

UNIT #	*(unit number)*
INSTALLED BY:	*(contracting company's name)*
WARRANTY EXPIRES:	*(month/day/year)*
COMPRESSOR WARRANTY EXPIRES:	*(month/day/year)*

K. Manufacturer's Services

1. Provide manufacturer's startup service, field testing, and instruction to PGCPS Building Services on operation and maintenance of boiler(s) for a minimum of for 2 years each boiler.
2. Operation and test shall be no less than twenty four (24) hours for each boiler.

V. Demonstration

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-tube boilers. Refer to Division 1 Section "Closeout Procedures and Demonstration and Training."

END OF SECTION

Part 1 - General

I. Related Documents
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

II. Summary
   A. This Section includes the following:
      1. Feedwater pumps and receivers.

III. Submittals
   A. Product Data: For each type of product indicated. Include manufacturer's technical Product Data; rated capacity of selected model; temperature and net-positive suction head required characteristics; pump performance curve with selection points clearly indicated; shipping, installed, and operating weights; furnished specialties; and accessories.
   B. Shop Drawings: Detail fabrication and installation and indicate dimensions, weights, loadings, required clearances, method of field assembly, and components.
      1. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
   C. Maintenance Data: For feedwater units to include in maintenance manuals specified in Division 1.

IV. Quality Assurance
   A. Product Options: Drawings indicate size, profiles, and dimensional requirements of feedwater units and are based on the specific types and models indicated. Other manufacturers' products complying with requirements may be considered. Refer to Division 1 Section "Substitutions."
   B. Regulatory Requirements: Fabricate and test unit according to ASME PTC 12.1, "Closed Feedwater Heaters."
   C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
   D. ASME Compliance: ASME B31.9, "Building Services Piping," for low-pressure systems equal to or less than 15 psig. Safety valves and pressure vessels shall bear the appropriate ASME label.

V. Delivery, Storage, And Handling

A. Preparation for Shipping: Clean flanges and exposed-metal surfaces and treat with anti-corrosion compound after assembly and testing. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.
B. Store units in dry location.
C. Retain protective flange covers and machined-surface protective coatings during storage.
D. Protect bearings and couplings against damage from sand, grit, and other foreign matter.
E. Comply with manufacturer's written rigging instructions.

Part 2 - Products

I. Manufacturers
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Feedwater Units:
a) Alyan Pump.
b) Aurora/Pentair Pump Group.
c) BFS Industry Incorporated.
d) Bryan Boilers; Bryan Steam Corp.
e) Cleaver-Brooks; Div. of Aqua-Chem, Inc.
f) Dixon Boiler Works.
g) Donlee Technologies, Inc.; Boiler Div.
h) Flotronics, Inc.
i) Gerow Equipment Co.; Pump & Hydraulic Division.
j) Hurst Boiler & Welding Co., Inc.
k) ITT Fluid Handling; ITT Fluid Technology Corp.
l) Kewanee Boiler Manufacturing Co.
m) Lattner Boiler Manufacturing Co.
n) PVI Industries Inc.
o) Roth Pump Co.; a subsidiary of Roy E. Roth Co.
p) Sellers Engineering Co.
q) Shippensburg Pump Co., Inc.
r) Skidmore.
s) Smith-Koch, Inc.
t) Superior Boiler Works, Inc.
u) U.S. Deaerator Co.

II. Feedwater Units

A. Description: Factory-assembled and -tested unit consisting of a condensate receiver, feedwater pumps, controls, and the following features and accessories:

1. Liquid-filled thermometer graduated in both Fahrenheit and Celsius.
2. Gage glass with stops at top and bottom.
3. Inlet strainer.
4. Lifting eyes.
5. Companion flanges.
6. Pump-discharge check valve.
7. Pump-discharge pressure gauge.
8. Pump-suction isolation valve.
9. Pump-discharge isolation valve.

B. Makeup-Water Assembly: Float-operated, makeup-water valve; inlet strainer; and three-valve bypass.

C. Factory-Furnished Pipe, 2-1/2" NPS and Smaller: ASTM A 53, Type S (seamless), Grade A, Schedule 80, with threaded joints and malleable-iron fittings of class to match pressure rating of pipe.

D. Factory-Furnished Pipe, 3" NPS and Larger: ASTM A 53, Type E (electric-resistance welded), Grade A, Schedule 80, with welded joints and malleable-iron fittings of class to match pressure rating of pipe.

E. Receiver Material: Close-grain cast iron.

1. Finish: Painted exterior.
2. Arrangement: Floor mounted.

F. Mounting Frame: Structural-steel stand to support receiver and pumps. Fabricate stand with bracing adequate for seismic forces according to authorities having jurisdiction and to allow anchoring mounting frame to floor.

G. Vertical Feedwater Pump: Flange-mounted, closed-coupled, multistage, radially split case design centrifugal pump; rated for 175-psig minimum working pressure and a continuous water temperature of 225 deg F; with the following features:

1. Impeller: Bronze or Stainless steel.
2. Seals: Mechanical.
3. Motor: Open dripproof.

H. Horizontal Feedwater Pump: Base-mounted, single-stage, radially split case design centrifugal pump; rated for 175-psig minimum working pressure and a continuous water temperature of 225 deg F; with the following features:
   1. Impeller: Bronze.
   2. Coupling: Flexible.
   3. Seals: Mechanical.
   4. Motor: Totally enclosed fan cooled.

I. Feedwater Pump Control Panel: Unit mounted, factory wired, and including the following:
   1. NEMA 250, Type 2 enclosure.
   2. Combination magnetic starters for each pump, with three overload relays, fused disconnect switch, and cover interlock.
   3. Numbered terminal block.
   4. Removable control mounting plate.
   5. Electric alternator for duplex units.
   6. Pilot lights for pump running and alarm.
   7. Alarm bell and silence switch.
   8. Elapsed-time run meter, graduated in hours.
   9. Fusible, control-circuit transformer where motor voltage exceeds 130 V.

J. Feedwater Pump Control Sequence: Boiler water-level controller starts lead pump; alternator switches lead and lag pumps after each cycle. Low-level receiver float switch opens makeup-water solenoid valve.

Part 3 - Execution

I. Examination
   A. Examine equipment foundation and anchor-bolt locations for compliance with requirements for installation and other conditions affecting performance.
   B. Examine roughing-in for condensate return piping systems to verify actual locations of piping connections before equipment installation.
   C. Proceed with installation only after unsatisfactory conditions have been corrected.

II. Installation
   A. Install unit level and plumb and to permit access for maintenance.
   B. Support piping independent of pumps.
   C. Install base-mounted pumps on concrete bases with grouted base frames.
   D. Install parts and accessories shipped loose.

III. Connections

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Connect makeup-water piping and cooling-water piping with reduced-pressure backflow preventers.

D. Install overflow drain piping to nearest floor drain.

E. Install vents and extend to outdoors; terminate with elbow turned down and an insect screen.

F. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

IV. Field Quality Control

A. Testing: Perform the following field quality-control testing:

1. After installing unit and after electrical circuitry has been energized, test for compliance with requirements.

B. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:

1. Inspect field-assembled components, equipment installation, and piping and electrical connections for compliance with manufacturer's written instructions.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Check bearing lubrication.
4. Verify proper motor rotation.
5. Start up service.
6. Report results in writing.

V. Adjusting

A. Adjust boiler water-level controls to properly stage unit.

B. Set field-adjustable makeup-water and cooling-water controls.

VI. Cleaning

A. Clean equipment internally; remove coatings applied for protection during shipping and storage, foreign material, and oily residue according to manufacturer's written instructions.

B. Clean strainers.

VII. Demonstration

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
2. Review data in maintenance manuals. Refer to Division 1 Section "Contract Closeout."
3. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
4. Schedule training with Owner, through Engineer, with at least seven days' advance notice.

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 -General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods shall apply to this section.

II. Scope
   A. Provide and install unit heater as shown on the drawings and specified herein.
   B. Items included in this specification include (but are not limited to):
      1. Cabinet Unit Heaters
      2. Hot Water Unit Heaters

III. Quality Assurance
   A. The unit heater shall have published ratings and be UL listed and bear the UL label.
   B. Equipment installer shall attend a controls coordination meeting with the Section 230923 contractor as described in 230923, 1.03.

IV. Submittals
   A. Provide shop drawings on this equipment as described in Section 230100 - 1.04. The controls coordination meeting described in 15900 shall be held before the shop drawings are submitted.

Part 2 - Products

I. The unit heaters shall be of type and capacity shown on the drawings. Acceptable manufacturers include:
   A. Indeeco
   B. Trane
   C. Reznor
   D. Sterling

II. Motor Requirements
   A. Motor requirements apply to factory-installed and field-installed motors, except as follows:
      1. Different ratings, performance, or characteristics for a motor are specified in Section 230513.

2. Manufacturer for a factory-installed motor requires ratings, performance, or characteristics, other than those specified in this Section, to meet performance specified.

III. Motor Characteristics

A. Frequency Rating: 60 Hz.

B. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.

C. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.

D. Duty: Continuous duty at ambient temperature of 105 deg F and at altitude of 3300 ft above sea level.

E. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

F. Enclosure: Open dripproof.

IV. Polyphase Motors

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium efficiency.

C. Stator: Copper windings, unless otherwise indicated.

D. Rotor: Squirrel cage, unless otherwise indicated.

E. Bearings: Double-shielded, prelubricated ball bearings suitable for radial and thrust loading.

F. Temperature Rise: Match insulation rating, unless otherwise indicated.

G. Insulation: Class F, unless otherwise indicated.

H. Code Letter Designation:

1. Motors 15 hp and Larger: NEMA starting Code F or G.
2. Motors Smaller Than 15 hp: Manufacturer's standard starting characteristic.

I. Enclosure: Cast iron for motors 7.5 hp and larger; rolled steel for motors smaller than 7.5 hp.

1. Finish: Gray enamel.

V. Polyphase Motors With Additional Requirements

A. Motors Used with Reduced-Inrush Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
   1. Designed with critical vibration frequencies outside operating range of controller output.
   2. Temperature Rise: Matched to rating for Class B insulation.
   3. Insulation: Class H.
   4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Source Quality Control: Perform the following tests on each motor according to NEMA MG 1:
   1. Measure winding resistance.
   2. Read no-load current and speed at rated voltage and frequency.
   3. Measure locked rotor current at rated frequency.
   4. Perform high-potential test.

VI. Single-phase Motors

A. Type: One of the following, to suit starting torque and requirements of specific motor application:
   1. Permanent-split capacitor.
   2. Split-phase start, capacitor run.
   3. Capacitor start, capacitor run.

B. Shaded-Pole Motors: For motors 1/20 hp and smaller only.

C. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

D. Bearings: Ball type for belt-connected motors and other motors with high radial forces on motor shaft; sealed, prelubricated-sleeve type for other single-phase motors.

E. Source Quality Control: Perform the following tests on each motor according to NEMA MG 1:
   1. Measure winding resistance.
   2. Read no-load current and speed at rated voltage and frequency.
   3. Measure locked rotor current at rated frequency.
   4. Perform high-potential test.

Part 3 - Execution

I. Motor Installation
   A. Anchor each motor assembly to base, adjustable rails, or other support, arranged and sized according to manufacturer's written instructions. Attach by bolting. Level and align with load transfer link.
   B. Install motors on concrete bases complying with Division 3, as required.

II. Field Quality Control
   A. Prepare for acceptance tests as follows:
      1. Run each motor with its controller. Demonstrate correct rotation, alignment, and speed at motor design load.
      2. Test interlocks and control features for proper operation.
      3. Verify that current in each phase is within nameplate rating.
      4. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

III. Adjusting
   A. Align motors, bases, shafts, pulleys and belts. Tension belts according to manufacturer's written instructions.

END OF SECTION

Part 1 - General

I. Related Documents
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

II. Summary
   A. This Section includes shell-and-tube heat exchangers.

III. Submittals
   A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.
   B. Shop Drawings: Signed and sealed by a qualified professional engineer. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
      1. Design Calculations: Calculate requirements for selecting seismic restraints and for designing bases.
      2. Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
   C. Coordination Drawings: Equipment room, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
      1. Tube-removal space.
      2. Structural members to which heat exchangers will be attached.
   D. Manufacturer Seismic Qualification Certification: Submit certification that heat exchanger, accessories, and components will withstand seismic forces defined in Division 15 Section "Mechanical Vibration and Seismic Controls." Include the following:
      1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
         a) The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
         b) The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
      2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Operation and Maintenance Data: For heat exchangers to include in emergency, operation, and maintenance manuals.

IV. Quality Assurance

A. Product Options: Drawings indicate size, profiles, performance, and dimensional requirements of heat exchangers and are based on the specific equipment indicated. Refer to Division 1 Section "Product Requirements."

B. ASME Compliance: Fabricate and label heat exchangers to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," Division 1.

C. Registration: Fabricate and label shell-and-tube heat exchangers to comply with the Tubular Exchanger Manufacturers Association's standards.

Part 2 - Products

I. Manufacturers

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

B. Approved Manufacturers:

1. Armstrong Pumps, Inc.
2. ITT Industries; Bell & Gossett.
3. Taco, Inc.

C. Configuration: U-tube with removable bundle.

D. Shell Materials: Steel.

E. Head:

1. Materials: Cast iron.
2. Flanged and bolted to shell.

F. Tube:

1. Seamless copper tubes.
2. Tube diameter is determined by manufacturer based on service.

G. Tubesheet Materials: Steel tubesheets.

H. Piping Connections:

1. Shell: Flanged inlet and threaded outlet fluid connections, threaded drain, and vent connections.

2. Head: Threaded inlet and outlet fluid connections.

I. Support Saddles:

1. Fabricated of material similar to shell.
2. Foot mount with provision for anchoring to support.
3. Fabricate attachment of saddle supports to pressure vessel with reinforcement strong enough to resist heat-exchanger movement during a seismic event when heat-exchanger saddles are anchored to building structure.

Part 3 - Execution

I. Examination

A. Examine areas for compliance with requirements for installation tolerances and for structural rigidity, strength, anchors, and other conditions affecting performance of heat exchangers.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

II. Heat-exchanger Installation

A. Install shell-and-tube heat exchangers on saddle supports.

B. Install shell-and-tube heat exchangers on concrete base. Concrete base is specified in Division 15 Section "Basic Mechanical Materials and Methods," and concrete materials and installation requirements are specified in Division 3.

C. Concrete Bases: Anchor heat exchanger to concrete base.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Cast-in-place concrete materials and placement requirements are specified in Division 3.

III. Connections

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Maintain manufacturer's recommended clearances for service and maintenance. Install piping connections to allow service and maintenance of heat exchangers.

C. Install shutoff valves at heat-exchanger inlet and outlet connections.

D. Install relief valves on heat-exchanger heated-fluid connection and install pipe relief valves, full size of valve connection, to floor drain.

E. Install vacuum breaker at heat-exchanger steam inlet connection.

F. Install hose end valve to drain shell.

IV. Field Quality Control

A. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

V. Cleaning

A. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 -General Requirements, Section 230100 - General Provisions, and Section 230100 - Basic Materials and Methods, shall apply to this section.

II. Scope
   A. A complete factory assembled packaged water-cooled hermetic centrifugal water chiller shall be installed.

III. Quality Assurance
   A. Unit shall be run tested at the factory and start-up and checkout shall be done by a factory certified technician. Pressurized components shall comply with the ASME code for unfired pressure vessels.
   B. Manufacturer shall provide a certification that the equipment has been performance tested at the factory. Certification shall record the unit capacity in BTU/hour and kilowatts.
   C. Chiller performance shall be rated in accordance with Air Conditioning and Refrigeration Institute (ARI) Standard 550, latest edition.
   D. Equipment and installation shall be in compliance with Safety Code for Mechanical Refrigeration, ANSI/ASHRAE 15-2004.
   E. Factory start-up- The manufacturer shall supply complete factory start-up by a factory approved start-up agent.
   F. Equipment installer shall attend a controls coordination

IV. Submittals
   A. Provide shop drawings on this equipment as described in section 230100, 1.04. The controls coordination meeting described in 230923, 1.03 shall be held before the shop drawings are submitted.

Part 2 - Products

I. Chiller
   A. The chiller shall be of the type and capacity shown on the equipment schedule on the drawings. Absorption type chillers are not acceptable. Acceptable manufacturers include:

1. Trane
2. Carrier
3. Daikin/McQuay
4. York

B. Unit Description - The chiller shall be a factory assembled, piped, wired and tested unit consisting of an evaporator, condenser, compressor, control panel, refrigerant piping and purge system all assembled on one base with accessories as required in this specification or as shown on the drawings. A matching motor starter shall be located as shown on the drawings.

C. Refrigerant – The chiller shall use refrigerant R-134a or R-410a.

D. Evaporator and Condenser - Shall be of shell and tube type. Test pressures shall be 45 psig minimum for the refrigerant side and 225 psig for the water side of the shells. Provide refrigerant circuit safety rupture disc. Condensing circuit marine type water box with taps for vents and drains shall be hydrostatically tested at 1.5 times working pressure. Provide fixed orifice return liquid refrigerant flow control.

E. Compressor - Shall be direct drive, single or multiple stage design with high strength aluminum alloy, proof tested statically and dynamically balanced impellers keyed directly to motor shaft. Hermetic compressor motor shall be liquid refrigerant cooled with inherent low voltage protection, each phase motor winding temperature sensing for stopping by any phase sensing excessive temperature. Inherent single-phase protection shall operate in the same manner. Capacity control shall be variable inlet guide vanes capable of modulating performance from 100 to 10 percent of rated unit capacity at design conditions. Provide submerged oil pump for lubrication.

F. Compressors

1. Semi-Hermetic Compressors:
    a) Compressor shall be semi-hermetic with a suction gas cooled motor, vibration isolators, thermal overloads, oil sight glass, manual reset high-pressure switch, pump-down low-pressure switch, suction line strainer, and reversible oil pumps for forced-feed lubrication and a maximum operating speed of 1,750 rpm.
    b) Provide thermostatically-controlled crankcase heater to evaporate refrigerant returning to crankcase during shutdown. Energize heater when compressor is not operating.
2. Rotary Screw Compressors:

a) Compressor shall be made of cast iron and precision machined to provide minimal clearance for the rotors.
b) Provide a bursting disc to meet the requirements of the ANSI/ASHRAE 15: Safety Standard for Refrigeration Systems. Rotors shall be manufactured from forged steel and shall use asymmetrical profiles.
c) Compressor shall incorporate a complete anti-friction bearing design for reduced power and increased reliability. Provide four (4) separate cylindrical roller bearings to handle radial loads. Provide two (2) 4-point angular contact ball bearings to handle axial loads. Together, they shall maintain accurate rotor positioning at all pressure ratios, minimizing blowby and maintaining efficiency.

3. Hermetic Scroll Compressors
   a) Provide hermetic direct-drive scroll compressors, with fixed compression, and integral centrifugal oil pump, and check valve on the scroll discharge port.
   b) Statically and dynamically balance rotating parts.
   c) Provide reversible oil-pump lubrication system arranged to ensure adequate lubrication during starting, stopping, and normal operation.
   d) Provide compressor with automatic capacity-reduction equipment consisting of suction-valve unloaders. Use lifting mechanism operated by solenoid valve. Provide unloaded compressor start.
   e) Provide constant speed, compressor motor, suction-gas cooled, with overheating protection (coordinate with PGCPS building services). Supply complete with starter.
   f) Provide thermostatically-controlled crankcase heater to evaporate refrigerant returning to crankcase during shutdown. Energize heater when compressor is not operating.
   g) Provide a hot-gas muffler in the discharge of each compressor.

G. Refrigerant Isolation Valves - Factory-installed condenser inlet and outlet refrigerant valves shall allow isolation of the full refrigerant charge in the condenser while servicing the chiller.
H. Control Panel - Shall be electronic with microprocessor, current limiter, temperature control system with dead band range, indicator lights and gauges, low refrigerant temperature override, unloaded start, anti-recycle timer to limit starts to two per hour,

oil pump operation, purge system operation, safety controls, and integral fused control circuits. Provide Expanded Service Panel located in the chiller control panel for reset of chilled water temperature based on return water temperature. Purge System - Shall be provided to remove non-condensable gasses and return refrigerant to the machine. Provide a communication interface between the chiller and the building energy management system. Provide all necessary protocol documentation and gateway hardware and software (if required) such that the section 15900 system supplier may successfully create a communication interface between the control system furnished in this section of the specification and the 15900 control system. Provide an adequate level of technical support to guide the section 15900 personal towards completion of subject communication interface. Protocol must support reading/writing status and analog and digital point information from this section of the specification.. All documentation, gateway hardware and software, and required technical support are understood to be included in the bid. The points listed in section 15900 input/output summaries as well as those below shall be the minimum acceptable.

1. Chilled water pump request.
2. Chilled water setpoint.
3. Chiller enable/disable.
4. Chiller current draw.
5. Entering water temperature.
6. Leaving water temperature.
7. Compressor starts.
8. Compressor run time.
9. Alarm.
10. Present operating mode

I. Integral Compressor Motor Starter - Shall be closed transition Wye-Delta type enclosed in a NEMA-1 enclosure with hinged door. Wires, busbars, and fittings shall be copper. Anti-recycling timer shall be included. Provide lugs for connection of specified conductors.

II. Refrigerant Leakage Sensor

A. A sensor mounted within the chiller room shall monitor refrigerant levels in the room. The sensor shall measure and indicate refrigerant levels ranging from 0-1000 parts per million. The sensor shall have an alarm setting of 1000 PPM which will activate audible and visual alarms located in the chiller room, outdoors at the chiller room entrance, and

in the building outside of the chiller room. Exceeding the alarm setting of the sensor shall also activate the chiller room emergency exhaust fan (and de-energize the boilers and water heaters if located in the chiller room). Interlock wiring to be provided by the mechanical contractor.

III. Signage

A. Provide signage outdoors on the exterior door to the chiller room, and indoors on the outside of the chiller room door, which states "DO NOT ENTER WHEN ALARM IS ACTIVE. CALL THE PGCPS MAINTENANCE DEPARTMENT. " 301-952-7815.

B. Provide hazard signage outdoors on the exterior door to the chiller room, and indoors on the outside of the chiller room door, to comply with the NFPA 704 requirements for use of refrigerants R-134a R-410a. Signs shall be a minimum of 6" x6" and shall display the hazard ratings.

Part 3 - Execution

I. Installation

A. Factory start-up- The manufacturer shall supply a complete factory start-up by a factory approved start-up agent.

B. Insulation - Insulate the evaporator shell, exposed refrigerant circuit piping and auxiliary water piping as required. Insulation shall comply with the requirements of Section 15250.

C. Installation - The chiller shall be installed in accordance with the manufacturer's recommendations. Provide auxiliary water supply to purge unit and oil cooler.

D. Isolation - The chiller shall be mounted on spring vibration isolators.

E. Pipe Connections - The chiller shall have a marine water box on the condenser water piping connections to the machine and either a marine water box or flanged pipe connections on the chilled water piping connections to the machine to allow removal of headers for inspection, cleaning, or removal of tubes. Two 1/2" valved connections shall be provided in tower water lines at machine inside the condenser shut off valves for future chemical cleaning.

F. Refrigerant Leakage Sensor Installation - Sensor and alarms shall be installed in accordance with manufacturer's recommendations.

G. Refrigerant Vent - Provide vent piping from rupture disc to outside of building. Piping shall be sized as recommended by ARI.

H. Provide an engraved nameplate permanently affixed to the front of the control cabinet with the following information:

UNIT #	*(unit number)*
INSTALLED BY:	*(contracting company's name)*
WARRANTY EXPIRES:	*(month/day/year)*
COMPRESSOR WARRANTY EXPIRES:	*(month/day/year)*

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 -General Requirements, Section 15010 - General Provisions, and Section 15050 - Basic Materials and Methods, shall apply to this section.

II. Scope
   A. A complete factory assembled package air-cooled water chiller shall be installed.

III. Quality Assurance
   A. Unit shall be run tested at the factory and start-up and check out shall be done by a factory certified technician. Pressurized components shall comply with the ASME code for unfired pressure vessels. Rating and construction shall be in accordance with ARI Standard 59086, ANSI B9.1 safety code and the National Electrical Code.
   B. Manufacturer shall provide a certification that the equipment has been performance tested at the factory. Certification shall record the unit capacity in BTU/hour and kilowatts.
   C. Factory start-up- The manufacturer shall supply complete factory start-up by a factory approved start-up agent.
   D. Equipment installer shall attend a controls coordination meeting with the section 15900 contractor as described in 230923, 1.03.

IV. Submittals
   A. Provide shop drawings on this equipment as described in section 230100, 1.04. The controls coordination meeting described in 230923, 1.03 shall be held before the shop drawings are submitted.

Part 2 - Products

I. Air Cooled Chiller
   A. The air-cooled chiller shall be of the type and capacity shown in the equipment schedule on the drawings. Absorption type chillers are not acceptable. Acceptable manufacturers include:
      1. Trane
      2. Carrier
      3. Daikin/McQuay

4. York

B. Unit Description - The Air Cooled chiller shall be a factory assembled, piped, wired and tested unit consisting of a corrosion protected steel casing, an evaporator, condensers, multiple scroll or screw compressors, control panel, refrigerant piping and dual refrigeration system all assembled on one base with accessories as required in this specification or as shown on the drawings. Motor starters shall be unit mounted. The refrigerant used shall have an ozone depletion potential of less than .05 and a global warming potential of less than 0.37, (R-134A, R-410A).

C. Unit Casing - Unit shall be enclosed in a galvanized steel casing, zinc phosphatized, with an electrostatically applied baked enamel finish, capable of withstanding Federal Test Method Standard No. 141, Method 6061, 500 hour salt spray test.

D. Evaporator/Cooler - Shall be shell and tube type with removable heads and shall have two independent direct-expansion refrigerant circuits. Cooler shall be tested and stamped in accordance with ASME code for refrigerant side working pressure of 235 psig and a minimum waterside working pressure of 150 psig. Copper tubes shall be rolled into the tube sheets. Shell shall be covered with 3/4" layer of closed-cell foam plastic, vapor insulated.

E. Condenser
   1. Air cooled condenser coils shall have aluminum fins mechanically bonded to seamless copper tubes, cleaned, dehydrated, sealed, leak tested at 150 psig and pressure tested at 450 psig.
   2. Condenser fans shall be propeller type with PVC coated steel wire safety guards, balanced statically and dynamically, and shall discharge vertically.
   3. Condenser fan motors shall have inherent overcurrent protection.
   4. Provide metal hail guards to protect the condenser coil from damage.

F. Compressors - Shall be scroll hermetic type with a maximum speed of 3500 rpm (up to 200 tons), or rotary screw (200 Tons and above), serviceable and shall have an automatically reversible oil pump and operating oil charge. Compressors shall be equipped with suction and discharge shutoff valves and shall be mounted on individual spring vibration isolators. Each compressor motor shall be cooled by suction gas passing around the motor windings and shall be thermally protected with manual restart after thermal or pressure overload stoppage. Each compressor shall be equipped with an insert type crankcase heater to control oil dilution during shutdown.

G. Refrigeration Circuit - Each refrigeration circuit shall include: hot gas muffler, combination moisture indicator and sight glass, replaceable core refrigerant filter drier, liquid line solenoid valve, expansion valve, suction and discharge pressure gauges with manual shutoff valves, high side pressure relief device, and charging valve.

H. Controls

1. Unit controls, including microprocessor, shall be factory mounted and wired in a weatherproof enclosure with hinged access doors for easy access. The controls shall include automatic lead-lag except where noted, pumpdown at beginning and end of every circuit cycle, loss-of-charge protection, inherent low water flow protection, low chilled water temperature safety, low- and high-suction superheat protection, low oil pressure protection for each circuit, ground current protection for each compressor, low control voltage to unit, current limit, field power and control circuit terminal blocks, compressor and fan motor circuit breakers, ON/OFF switch, replaceable relay board, individual solid-state compressor protection board, leaving chilled water set point board, diagnostic digital display module, a microprocessor board and a temperature reset board. The chiller shall be capable of sending a chill water pump run request to the building automation system.
2. Unit control capacity is based upon leaving water temperature and will be compensated by return water temperature.
3. Minimum number of capacity control steps shall be as shown in the equipment schedule.
4. Provide a definite purpose magnetic contactor for each compressor.
5. Calibrated circuit breakers shall be factory installed for each compressor, shall be manual reset and ambient insensitive, and shall open all three phases should an overload occur on any phase.
6. Unit primary electrical power supply shall be connected to a single point with lugs sized for specified conductors.
7. Control voltage shall be provided by a factory installed integral control transformer.
8. Heat tracing for exterior piping shall be provided by a separate 120 volt, single phase power supply.
9. Provide a barrel freeze alarm output for connection to the BAS.

I. Chiller shall be capable of operating at ambient air temperatures down to 0 deg F without the use of glycol or any other type of antifreeze. Chillers that do not meet this requirement are not acceptable.

J. Flow switches- switches for flow conformation shall be provided. Switches shall be paddle type with stainless steel bellows and paddle. Switches shall be suitable for outdoor installation.

Part 3 - Execution

I. Installation

A. Factory Start-up: The manufacturer shall supply complete factory start-up by a factory approved start-up agent.

B. Installation: The chiller shall be installed in accordance with the manufacturer's recommendations.

C. Install isolation valves on evaporator water inlet and outlet at chiller.

D. Install thermometers on evaporator water inlet and outlet at chiller.

E. Isolation: Provide spring isolators as recommended by chiller manufacturer.

F. Pipe Connections: The machine shall have water boxes or the contractor shall provide flanged pipe connections in the piping adjacent to the machine to allow removal of headers for inspection, cleaning or removal of tubes.

G. Provide an engraved nameplate permanently affixed to the front of the control cabinet (inside of cabinet for outdoor locations) with the following information:

UNIT #	*(unit number)*
INSTALLED BY:	*(contracting company's name)*
WARRANTY EXPIRES:	*(month/day/year)*
COMPRESSOR WARRANTY EXPIRES:	*(month/day/year)*

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 - General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope
   A. The work covered under this section shall include a complete factory-assembled closed circuit cooling tower of induced draft design with vertical air discharge shall be installed.

III. Quality Assurance
   A. Capacity shall be in accordance with published ratings, wet deck ASTM standard E-84 flame spread rated and finish corrosion protection tested per ASTM B117-64. Towers thermal performance shall be in accordance with CTI standard 201.
   B. Equipment installer shall attend a controls coordination meeting with the Section 230923 contractor as described in 230923, 1.03.

IV. Submittals
   A. Provide shop drawings on this equipment as described in Section 230100 - 1.04. The controls coordination meeting described in 230500 shall be held before the shop drawings are submitted.

Part 2 - Products

I. Cooling Tower
   A. The cooling tower shall be of the type and capacity shown on the drawings. Acceptable manufacturers include:
      1. Baltimore Aircoil
      2. Evapco
      3. Trane
   B. Unit Description - The cooling tower shall be a factory assembled, piped, wired and tested unit consisting of a stainless steel housing, distribution basins, wet deck, drift eliminator, propeller fan and fan motor and drive, recirculating spray water pump and piping, positive closure damper hood and actuator, all assembled on one base with accessories using series 300 stainless steel nuts and bolts, as required in this specification or as shown on the drawings.

C. Casing and Basins - Shall be constructed of heavy gauge, stainless steel including all angles or channels. All casing exterior panels shall be stainless steel panels. Piping connections shall be flanged.

D. Stainless Steel Coil - Coil shall be constructed of Type 304 stainless steel serpentine tube. Tubes shall be sloped for free drainage and coil assembly shall be pneumatically tested at 375 psig (2,685 kPa). Coil shall be ASME B31.5 compliant.

E. Hot Water Distribution Basins - Shall be type 304 stainless steel and open gravity type with distribution weirs and plastic metering orifices. Basin shall include integral balancing valves and removable basin covers. Each cell shall have a single water inlet with pre-strainer assembly, or external factory mounted strainer. PVC distribution system with plastic or brass nozzles are acceptable.

F. Cold Water Basin - Shall be type 304 stainless steel and include circular access doors; large area strainers type 304 stainless steel with perforated openings sized smaller than water distribution metering orifices; and an integral anti-vortexing hood to prevent air entrainment.

G. Wet Deck and Drift Eliminator - Shall be manufactured and performance tested by the manufacturer and shall be 15 mils thick polyvinyl chloride. It shall have a flame spread rate of 5 per ASTM E84-77a.

H. Air Inlet Louvers - Shall be wave form, fiberglass reinforced polyester or stainless steel, spaced to minimize air resistance and prevent splash-out.

I. Positive Closure Damper Hood - Provide coil air intake hoods with factory mounted positive closure dampers with stainless steel linkages and damper actuators. The hood shall be factory insulated.

J. Fan - Shall be fixed pitch cast aluminum propeller type mounted on a solid steel fan shaft supported by heavy duty, self-aligning relubricatible 40,000 hour life bearings with cast iron housings. Extended lube lines shall be provided for ease of maintenance. Provide galvanized steel fan guard. To maintain the quality of the local environment, the closed circuit cooling tower shall be furnished with a low sound fan.

K. Fan Motor and Drive

1. Motor - Shall be drip-proof ball-bearing type with 1.15 service factor. High efficiency motor shall be rated for VFD duty and suitable for outdoor service and operation on indicated electrical service. Motor shall be mounted on easily adjusted heavy duty motor base located so that drive and motor are in a protected position.

2. The V-belt fan drive shall be designed for not less than 150% of motor nameplate horsepower. Drive and all moving parts shall be completely enclosed by removable stainless steel screens.
3. Install VFD Variable Frequency Drive per specification Section 262923.
4. Provide a vibration cutout switch to de-energize fan motors in case of excessive vibration.

L. Recirculating Spray Water Pump
1. Pump shall be close coupled, bronze fitted centrifugal pump.
2. Motor shall be totally enclosed fan cooled (TEFC) motor.
3. Provide bleed line with metering valve from pump discharge to overflow.

M. Water Level Control Package: Manufacturer's standard mechanical make up water valve (rated at 80 psig) and a plastic or bronze float with adjustable linkage.

N. Basin Sump Heater Package - Provide heaters, contactors for each heater element, control transformer, basin thermostat, and low water cut out. Provide and wire one heater package for each tower cell. Provide a 1" threaded outlet in each cells sump for the purposes of temperature monitoring via the ATC. Sump shall be stainless steel type; no exceptions.

O. Internal/External Working/Service Platforms- provide complete internal/external working/service platforms and ladder systems for the maintenance and service of all drive components and motor assemblies, at access doors for plenum sections and at the louver face. Towers which require service/maintenance from the top (fan deck) shall be provided with a perimeter handrail system with a ladder from grade to the fan deck. Ladders for external platforms shall extend to grade.

Part 3 - Execution

I. Installation

A. The cooling tower shall be installed as shown on the drawings and in accordance with the manufacturer's recommendations. Coordinate required elevation with supporting structure. Provide vibration isolation as shown on drawings.
1. Install OSHA approved ladders to all internal and external working/service platforms.
2. Install manufacturer's handrail system around the perimeter of the top of the unit.

II. Adjusting And Demonstration

A. Have manufacturer's representative inspect tower after installation is complete and submit report prior to start-up, verifying that installation is in accordance with specifications and manufacturer's instructions.

B. Have manufacturer's representative supervise rigging, hoisting, and installation of the cooling tower.

C. Provide manufacturer's representative for two consecutive 8-hour days working per tower for start-up of cooling tower and instruction of PGCPS' operating personnel.

III. Warranty

A. See Section 230100 for warranty information.

END OF SECTION

Part 1 - General

I. General
   A. Related Sections:
      1. Division 1 - General Requirements
      2. Division 1 - Special Procedures
      3. Section 230100 - General Provisions
      4. Section 230500 - Basic Materials and Methods

II. Section includes:
   A. Cooling tower
   B. Controls
   C. Ladder and handrails

III. Quality Assurance
   A. Capacity shall be in accordance with published ratings; wet deck ASTM standard E-84 flame spread rated and finish corrosion protection tested per ASTM B117-64. Towers thermal performance shall be in accordance with CTI standard 201.
   B. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."
   C. Equipment installer shall attend a controls coordination meeting with the Section 230923 contractor as described in 230923, 1.03.

IV. Submittals
   A. Provide shop drawings on this equipment as described in Section 230100 - 1.04. The controls coordination meeting described in 15900 shall be held before the shop drawings are submitted.
      1. Submit suggested structural-steel support including dimensions, sizes, and locations for mounting bolt holes. Include weight-distribution drawings, showing point loadings.
      2. Submit schematic showing capacity controls.
      3. Submit manufacturer's installation, operation, and maintenance instructions.

V. Delivery, Storage, And Handling
   A. Factory-assemble entire unit. For shipping, disassemble into as large as practical subassemblies so that minimum amount of field work is required for reassembly.

Part 2 - Products

I. Propeller Fan Cooling Tower

A. The propeller fan-cooling tower shall be of the type and capacity shown on the drawings.

B. Approved manufacturers:
   1. Baltimore Aircoil
   2. Trane
   3. Evapco

C. Cooling Tower
   1. Unit Description - The cooling tower shall be a factory assembled, piped, wired and tested unit consisting of a stainless steel housing, distribution basins, wet deck, drift eliminator, propeller fan and fan motor and drive, all assembled on one base with accessories using series 300 stainless steel nuts and bolts, as required in this specification or as shown on the drawings.
   2. Provide electric heaters in tower sump suitable to maintain temperature of water in sump at 42 deg F when outside temperature is 0 deg F. Control heaters from sump-mounted thermostat and interlock with float control so heaters operate only when there is water in sump.
   3. Provide capacity control suitable for stable operation down to 10 percent of rated cooling.

D. Fabrication
   1. Type: Suitable for outdoor use, section, counterflow, draw-thru type, complete with sump, fan, surface sections, drift eliminators, and motor.
   2. Casing: Galvanized steel (conforming to ASTM A 525) with Coating Designation G-235, or with Designation G-210 and a polymer coating.
      a) All joints sealed watertight.
      b) Fasteners: Corrosion resistance equal to or better than the materials being fastened.
      c) Rigging supports for handling cooling towers at job site.
   3. Fan: Shall be fixed pitch cast aluminum propeller type mounted on a solid steel fan shaft supported by heavy duty, self-aligning relubricatible 40,000-hour life bearings with cast iron housings. Extended lube lines shall be provided for ease of maintenance. Provide galvanized steel fan guard.
   4. Fan Motor and Drive
      a) Motor - Shall be drip-proof ball-bearing type with 1.15 service factor. High efficiency motor shall be rated for VFD duty and suitable for outdoor service and operation on indicated electrical service. Motor shall be mounted on easily adjusted heavy-duty motor base located so that drive and motor are in a protected position (coordinate with PGCPS building services).

b) The V-belt fan drive shall be designed for not less than 150% of motor nameplate horsepower. Drive and all moving parts shall be completely enclosed by removable stainless steel screens.

c) Install VFD Variable Frequency Drive per specification section 262923.

d) Provide a vibration cutout switch to de-energize fan motors in case of excessive vibration.

5. Fan Cylinder: One-piece, welded, hot-dip galvanized steel assembly with full-height inlet cylinder welded to fan deck.
6. Fan Guard: Welded, one-piece guard, rod and wire, hot-dip galvanized after fabrication.
7. Access: Large doors to air plenum, safety railings, and ladder from grade/roof to fan deck.
8. Distribution: Open basin gravity-type with plastic diffusing-type orifices.
9. Filling: Vertical sheets of polyvinyl chloride plastic or impregnated neoprene.
10. Control: Fan motor cycling.
11. Provide safety cage on ladder where fan deck is 20 feet (6 m) or more above tower base.
12. Wet Deck and Drift Eliminator: Shall be manufactured and performance tested by the manufacturer and shall be 15 mils thick polyvinyl chloride. It shall have a flame spread rating of 5 per ASTM E84-77a.
13. Air Inlet Louvers - Shall be waveform, fiberglass-reinforced polyester or stainless steel, spaced to minimize air resistance and prevent splash out.
14. Water Level Control Package: Manufacturer's standard mechanical make up water valve (rated at 80 psig) and a plastic or bronze float with adjustable linkage.
15. Starter - Shall be manufacturer specified. Coordinate with installation of VFD.
16. Basin Sump Heater Package: Provide heaters, contactors for each heater element, control transformer, basin thermostat, and low water cut out. Provide and wire one heater package for each tower cell. Provide a 1" threaded outlet in each cell's sump for the purposes of temperature monitoring via the ATC. Sump shall be stainless steel type; no exceptions.
17. Internal/External Working/Service Platforms: provide complete internal/external working/service platforms and ladder systems for the maintenance and service of all drive components and motor assemblies, at access doors for plenum sections and at the louver face. Towers which require service/maintenance from the top (fan deck) shall be provided with a perimeter handrail system with a ladder from grade to the fan deck. Ladders for external platforms shall extend to grade.

18. Casing and Basins - Shall be constructed of heavy gauge, stainless steel including all angles or channels. All casing exterior panels shall be stainless steel panels. Piping connections shall be flanged.
    a) Hot water Distribution Basins - Shall be type 304 stainless steel and open gravity type with distribution weirs and plastic metering orifices. Basin shall include integral balancing valves and removable basin covers. Each cell shall have a single water inlet with pre-strainer assembly, or external factory mounted strainer. PVC distribution system with plastic or brass nozzles are acceptable.
    b) Cold Water Basin - Shall be type 304 stainless steel and include circular access doors; large area strainers type 304 stainless steel with perforated openings sized smaller than water distribution metering orifices; and an integral anti-vortexing hood to prevent air entrainment.

Part 3 - Execution

I. Installation
   A. The cooling tower shall be installed as shown on the drawings and in accordance with the manufacturer's recommendations. Coordinate required elevation with supporting structure. Provide vibration isolation as shown on drawings.
      1. Install OSHA approved ladders to all internal and external working/service platforms.
      2. Install manufacturer’s handrail system around the perimeter of the top of the unit.

II. Adjusting And Demonstration
   A. Have manufacturer’s representative inspect tower after installation is complete and submit report prior to start-up, verifying that installation is in accordance with specifications and manufacturer’s instructions.
   B. Have manufacturer’s representative supervise rigging, hoisting, and installation of the cooling tower.
   C. Provide manufacturer’s representative for two consecutive 8-hour days working per tower for start-up of cooling tower and instruction of PGCPS’ operating personnel.

III. Warranty
   A. See Section 230100 for warranty information.

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 -General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope
   A. The work covered under this section shall include energy recovery units.

III. Quality Assurance
   A. The system shall deliver the specified air volume at the static pressure scheduled.
   B. The unit shall be constructed to provide smooth interior surfaces and to limit the casing leakage at less than 1% of the specified air volume at operating static.
   C. Unit shall be constructed in accordance with CSA C22.2 and UL 1812 and shall carry the ETL label of approval.
   D. Unit shall be constructed in accordance with industrial design practices.
   E. Insulation shall comply with NFPA 90A requirements for flame spread and smoke generation.
   F. Airflow data shall comply with AMCA 210 method of testing.
   G. Cabinet and exterior components shall be tested and certified weatherproof.
   H. All units shall be 100% factory tested.
   I. All effectiveness data of heat and energy recovery components shall be certified by the ARI 1060 certification program directory.
   J. Factory Start-Up – The manufacturer shall supply complete factory start-up by a factory approved start-up agent.
   K. Equipment installer shall attend a controls coordination meeting with the division 230923 contractor as described in 230923, 1.03.

IV. Submittals
   A. Provide shop drawings on this equipment as described in Section 230100, 1.04. The controls coordination meeting described in 230923, 1,.03 shall be held before the shop drawings are submitted.

Part 2 - Products

I. Manufacturers

A. Energy recovery unit(s) shall be supplied by:
   1. Innovent Air Handling Equipment
   2. Seasons Four
   3. Greenheck
   4. AAON.

II. Equipment

A. General: Factory assembled, consisting of fan and motor assemblies (supply and exhaust), Flat Plate Heat Exchanger, Heat Recovery Wheel, all necessary dampers, hoods, plenums, filters, drain pans, wiring and controls. Unit shall be stand-alone controlled with all control devices provided by the unit manufacturer or control contractor. Unit shall have single point power connection.

B. Unit Cabinet:
   1. The energy recovery unit is to be installed outdoors by the mechanical contractor. Indoor units weatherized for outdoor use are not acceptable.
   2. All unit panels are fixed with zinc plated hexagonal head type screws complete with a washer and rubber gasket for a weatherproof assembly. Self-drilling, self-tapping screws are used and therefore no tools are required from the unit interior for panel removal. These panels allow for fast service to all major components.
   3. All panel joints must be caulked with a weatherproof silicone. The silicone used must be clear to match any color surfaces. After application, the silicone must react with atmospheric moisture to produce a formed-in-place silicone rubber glazing and curtain wall seal.
   4. The unit base frame shall be constructed from a bolted, structural formed G90 galvanized steel with internal structural cross members properly sized to allow rigging and handling of the unit. All major components shall be supported by the base without sagging or pulsating. Lifting lugs shall be provided and strategically located to allow equilibrium during lifting.
   5. Unit construction consists of an insulated 14 gauge galvanized structural frame complete with die cast aluminum corners. The rigid frame provides stable construction allowing for panel removal without affecting the unit integrity. Panels shall be double wall construction using 2" thick mineral wool insulation 1.5 lbs/ft3 density, 18 gauge galvanized steel exterior panels (satin coat finish) and 26 gauge G90 galvanized steel inner liner. The unit shall be designed to resist any snow, ice and wind loads, as well as seismic loads in compliance with the National Building

Code. Single wall construction with coated insulation will not be acceptable. Exposed insulation edges in the air stream will not be acceptable.

Insulating Value

	Thickness
Type of Insulation	2”
Mineral Wool (3.5 pcf)	R8.6
Urethane	R14.8

6. Internal partition wall shall be insulated and constructed the same as the unit cabinet.
7. Full size access door(s) to allow for periodic maintenance and inspections must be provided for all serviceable components Serviceable components include but are not limited to Coils, Heat Exchanger, Damper sections,Motor sections and piping enclosures. Doors shall be double wall construction made of 18 gauge galvanized steel on both outer and inner liner for maximum rigidity. Door insulation is the same as the unit panels. Provide doors with heavy duty corrosion resistant aluminum hinges that allow the door to open at 180°. Compression type handles are operable from both sides of the unit access door(s) and neoprene resilient bubble gaskets for an enclosure that is sealed tight shall also be provided. Plastic latches and hinges are not acceptable.
8. Outdoor constructed units shall have a pitched roof to dissipate water accumulation. Rain gutters must be provided above access doors. All roof joint seams are "T" shape construction, minimum height of 1.5", sealed and encapsulated by a metal strip.
9. All weather hoods for outdoor constructed units are provided with birdscreen and rain gutters. Hoods may ship loose for field assembly.
10. Recessed, double-sloped drain pans shall be made of formed sections of steel. Drain pans are sloped with a threaded drain pipe connection of 1 1/2" in diameter ending outside through the structural base channel. All drain pan corners shall be welded.
11. Paint:
    a) Outdoor constructed units shall have one coat of primer and two coats of enamel paint.

b) All galvanized steel surfaces that require paint shall be made of satin coat-finished galvanized steel of the specified gauge(s).

c) All galvanized steel surfaces without any paint shall be made of G90 galvanized steel of the specified gauges.

d) All unit surfaces that require paint must be cleaned and free from all oil, dirt and other contaminants before painting.

C. Energy Recovery Heat Wheel

1. Heat Wheels shall comply with UL standards.
2. Heat Wheel - Provide aluminum or polymer transfer media, flame spread rating of not more than 25 and smoke developed rating of not more than 50 and shall be independently tested in accordance with ASTM standard E-84. Rotor media shall be independently tested in accordance with ASHRAE Standards. It shall allow laminar flow (but not radial) at usual velocities and prevent leakage, bypassing and cross contamination by cross flow within wheel. Size the transfer media to allow passage of 300 micron particles without fouling or clogging. Treat media with non-degrading desiccant that is bacteriostatic, non-corroding and non-toxic. No asbestos material will be allowed. Wheel shall not condense water directly or require a condensate drain for summer or winter operation. Performance rating shall be in accordance with ARI Standard 1060.
3. Provide casing seals on periphery of rotor as well as on duct divider and purge section. Seals are to be adjustable, of extended life materials and effective in limiting air leakage.
4. Wheel shall be supported by ball or roller bearings and belt driven by a fractional horsepower, totally enclosed, NEMA Standard motor through a close coupled positively lubricated speed reducer, or gear/chain speed reduction.
5. Unit shall be constructed of heavy gage steel to insure rigidity and stability. Casing side panels shall be removable to insure easy access to internal parts. Provide integral flanges for flanged duct connection and provide lifting holes or lugs.

D. Defrost Strategies (As Required)

1. The traversing defrost system is DDC controlled. Independent traversing dampers with actuators and bypass damper (if free-cooling is required). This defrost strategy allows for the recovery of energy while the unit is in defrost.
2. Recirculation defrost including outside air, exhaust air and recirculation dampers with actuators and the appropriate controls.

3. Exhaust only defrost including outside air and exhaust air dampers with actuators and the appropriate controls.
4. Face and bypass defrost including face and bypass dampers with actuators and the appropriate controls. Bypass may also be used for free-cooling in summer operation (if required).

E. Fans:

1. Fan performance ratings for flow rate, pressure, power, air density, speed or rotation and efficiency shall be factory tested and shall comply with the requirements of AMCA 210.
2. All fans shall be statically and dynamically balanced and designed for continuous operation at the maximum rated fan speed and motor horsepower in accordance with AMCA 300.
3. Fans shall be of centrifugal type, rigidly braced and reinforced to help prevent vibration or pulsation. Wheel diameters and outlet areas shall be in accordance with the standard sizes adopted by AMCA.
4. Fan and motors shall be mounted inside the unit casing with 1" (minimum 90% efficiency) deflection spring vibration isolators and supplied with neoprene flexible connections.
5. Fans shall be selected for a stable operation, at least 20% under the fans first critical speed.
6. Units shall be equipped with non-overloading, airfoil, SWSI plenum fan, Arrangement 3 (AMCA labeled) supply and exhaust fans to provide scheduled airflows against static pressures indicated.
7. Fan shaft shall be solid steel, turned, ground, polished and completed with a corrosion resistant coating. Fan wheels shall be keyed to the shaft.
8. Bearings shall be heavy duty, grease-lubricated, self-aligning ball or pillow block type. Bearing shall be selected for a basic rating fatigue life (L-50) in excess of 200,000 hours at maximum operating speed in accordance with AFBMA 9 regulations.
9. Fan drives shall be designed for a 1.4 service factor. Drives are factory mounted with final alignment and belt adjustment made before unit start-up.
10. Belt drives with motor pulley shall be adjustable pitch for use with motors up to and including 10 HP. Fan pulleys shall be fixed pitch.

F. Motors:

1. All motors are internal to the unit casing and are mounted on an adjustable base allowing for belt alignment and tensioning.
2. Fan motors shall be heavy duty, 1800 rpm, high efficiency (E-pact Series), open drip proof (ODP), NEMA Design B with Class F insulation and 1.15 service factor. Motors shall be constant speed operable at field voltage: 460 Volts, 60 Hz, 3 phase.
3. Torque characteristics shall be sufficient to accelerate the drive loads satisfactorily.
4. Motor sizes shall be minimum size indicated in the equipment schedule. If not indicated, large enough so that the drive load will not require the motor to operate in the service factor range.
5. Temperature rating shall be 122°F (50°C) maximum temperature rise at 104°F (40°C) ambient for continuous duty at full load (Class B Insulation).
6. Motor construction shall be NEMA Standard MG 1, general purpose, continuous duty, Design B.
    a) Bases shall be adjustable.
    b) Bearings shall be:
        (1) Ball or roller bearing with inner and outer shaft seals.
        (2) Grease lubricated.
        (3) Designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motors.
        (4) Fully serviceable prelubricated 200,000 hour life ball bearings with externally mounted grease fittings shall be included on all units so bearings can be serviced without dismantling the unit. Provide internal grease tubings for servicing where applicable.
    c) Energy efficient motors shall have a minimum efficiency as scheduled in accordance with IEEE Standard 112-B. If efficiency is not specified, motors shall give a higher efficiency than "average standard industry motors" in accordance with IEEE Standard 112-B.

G. Filters:
1. Filters shall be UL 900 Class II.
2. Outside and return air inlet shall be equipped with galvanized steel racks that permit slide out removal of filters (side access) for units equal or smaller than 78”, and universal holding frames with upstream access for units taller than 78”.
3. Unit shall include 2" disposable type air filters, 25-30% DSE efficiency, consisting of viscous coated fibers with filtering media encased in fiberboard cell sides having

perforated metal grids on each face to provide media support. Airflow resistance with clean media shall not exceed 0.28 inch w.g. at a face velocity of 500 fpm and filter arrestance efficiency of 90% based on ASHRAE Test Standard 52. Metal filters may be accepted pending approval by PGCPS building services.

H. Dampers:
   1. Air leakage through a 48" x 48" damper shall not exceed 10.3 cfm/sq.ft. against 4 in. wg. differential static pressure at standard air. Standard air leakage data to be certified under AMCA certified rating program.
   2. Dampers are designed for operation in temperatures ranging between -40°F and 212°F.
   3. Unit shall be equipped with all necessary dampers. Dampers for outside air intake, exhaust air and all other dampers required for the system, including the dampers for defrost (if required).
   4. Intake outside air dampers are opposed blade type and exhaust air dampers are parallel blade type. For other dampers, see manufacturer's recommendations.
   5. Outside air dampers shall be motorized. Provide damper actuators with 24 VAC drive voltage. 0-10 VDC modulation.
   6. Exhaust air dampers shall be gravity backdraft type. Provide damper actuators with 24 VAC drive voltage. 0-10 VDC modulation.
   7. Dampers construction shall be as followed:
      a) Damper frame shall be extruded aluminum.
      b) Blades shall be extruded aluminum.
      c) Dampers shall be opposed blade type or parallel blades where indicated
      d) Neoprene flexible edge seals complete with bottom and top blade wiper seals.
      e) Frame and blades shall be non-insulated.

I. Coils – General Information:
   1. Acceptable coils shall have ARI Standard 410 certification and bear the ARI symbol. Coil manufacturer must be ISO 9002 certified.
   2. Coils shall be submerged in water and tested with a minimum of 315 psi air pressure for standard copper tube coils. Coils must display a tag with the inspector's identification as proof of testing.
   3. Tubes shall have a nominal thickness of 0.020" unless otherwise specified.
   4. Fins shall be made of 0.0075" thick aluminum unless otherwise specified.

5. Tubing, return bends and headers shall be constructed from UNS 12200 seamless copper conforming to ASTM B75 and ASTM B251 for standard pressure applications. Coil return headers shall be equipped with factory installed 1.2" fpt air vent connection placed at the highest point available on the face of the header (except for evaporator coils).
6. Casings and endplates shall be made of 16 gauge galvanized steel, meeting ASTM A527 unless otherwise noted. Double flanged casings on the top and bottom of finned height are to be provided to allow for stacking of the coils. On applications where cooling coils are stacked, use an intermediate drain pan to dissipate water accumulation. All drain lines shall be field trapped as per manufacturer's recommendations. A water level sensing device shall be provided in the unit condensate pan which will shut down the unit in the event this devices level is exceeded.
7. Piping, control valve and valve operator shall be supplied and installed by others.
    a) Hot Water Coils:
        (1) Coils shall be designed to withstand 250 psi maximum operating pressure and a maximum steam temperature of 300°F (149°C) for standard duty copper tube coils.
        (2) Coil tube size and wall thickness is 5/8" x 0.020" [16 x 0.5mm] standard for copper.
        (3) Standard construction fluid connections are male pipe thread (MPT) and constructed from red brass conforming to ASTM B43 or Schedule 40 steel pipe as a minimum.
    b) Chilled Water Coils:
        (1) Coils shall be designed to withstand 250 psi maximum operating pressure and a maximum fluid temperature of 300°F for standard duty copper tube coils.
        (2) Coil tube size and wall thickness is 5/8" x 0.020" standard for copper.
        (3) Standard construction fluid connections are male pipe thread (MPT) and constructed from red brass conforming to ASTM B43 or Schedule 40 steel pipe as a minimum.

J. Roofcurb: Roofcurb shall be supplied by the unit manufacturer for field assembly. Curb shall be one piece; two piece curbs will not be accepted. Curb shall consist of formed 18 gauge galvanized steel sections. Manufacturer’s curb is standard double wall, 18" in

height, 2" thick fiberglass insulation. Unit base design is made for recessed curb installation. Stiffeners will be provided for field assembly when required. Pitch roofcurb to match building roof. Provide wood nailer.

K. Sound Ratings:
   1. Energy recovery unit sound ratings shall be based on tests in a sound laboratory reverberant room strictly conforming to ASHRAE Standard 36-62, in accordance with AMCA 300 procedures. Sound data must be accurate to within + 5 db @ 63 Hz, + 4 db @ 125 Hz, + 2 db from 250-2000 Hz, + 3 db @ 4000 Hz and above.
   2. Where the manufacturer's sound power data is not published, an officer of the company must certify that sound data conforms to the above requirements. If the manufacturer does not have acoustical facilities in accordance with the above requirements, the contractor must submit certified data that the specified operating conditions, to determine sound power levels by octave band

L. Temperature Controls shall be accomplished by either of the following methods:
   1. Factory built-in controls shall be provided to interface with the ATC to accomplish control sequence as outlined in Automatic Temperature Control section of specifications.
   2. Field installed controls provided by the section 15900 contractor is acceptable provided the control sequence as outlined in Automatic Temperature Control section of specifications is met.
   3. The control contractor must have the ability to interface with and control the factory supplied outside airflow monitoring assembly.

M. A water level sensing device shall be provided in the unit condensate pan which will shut down the unit in the event this devices level is exceeded. Condensate float shall be located in a readily accessible location.

N. Electrical Components
   1. All electrical controls shall be ETL listed and the entire unit shall be factory wired in accordance with the National Electrical Code Standard.
   2. The outdoor constructed units shall be supplied with a weatherproof non-fused main power disconnect switch. A single point power connection shall be provided for all units.
   3. Unit shall be equipped with all necessary high voltage components as follows:
      a) Motor starters on all high voltage motors for constant speed applications.
      b) Thermal protection on all high voltage motors.

c) Fuses and fuse holders.

d) All necessary control transformers.

4. Unit shall be completed with all necessary relays, time delay, damper actuators with auxiliary switches (as required).
5. The automatic unit start-up is provided as standard via an external dry contact provided by others (ex: Building management system, DDC controller, time clock, etc.).
6. Terminal board shall be provided for low voltage control wiring. Low voltage is 24V.
7. Fan access doors are equipped with a momentary interrupt switch that shuts off the unit when a protected door is opened. These switches can be removed if belt guards are installed on the fan assembly.
8. An integral control panel shall be provided having a hinged access door and an approved locking device.
9. All control devices, except those not mounted directly to the unit, shall be factory mounted and wired. Control panel shall have a labeled strip to land all wires for field installed control components.
10. All components are fully wired and 100% tested prior to shipping.

Part 3 - Execution

I. Installation

A. Factory Start-up- The manufacturer shall supply complete factory start-up by a factory approved start-up agent.

B. The energy recovery units shall be installed complete with all accessories in accordance with the manufacturer's recommendations, as listed in the specifications and as shown on the drawings.

C. Three (3) sets of spare filters shall be provided in addition to the set used during construction with each unit. The filters shall be changed after the construction dust has been eliminated and before final inspection. The other set of filters shall be stored in the respective mechanical rooms or spaces.

D. Provide a typed list of all the different units and their filter sizes to be included in the O&M manuals. The list shall include the unit designation, filter size and the number of filters required for each unit. In addition to this, submit to the Owner three additional copies of the list, distributed to the building supervisor, PGCPS project manager of record and PGCPS building services.

E. Provide two (2) sets of spare fuses for each energy recovery unit.

F. Provide three (3) sets of spare belts per unit.

G. Warranty Tag - The Contractor shall attach an engraved weatherproof Guarantee or Warranty tag to the exterior of each unit. Identification tag shall be black with engraved 1/2 " white letters which reads:

UNIT #	*(unit number)*
INSTALLED BY:	*(contracting company's name)*
WARRANTY EXPIRES:	*(month/day/year)*
COMPRESSOR WARRANTY EXPIRES:	*(month/day/year)*

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 -General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope
   A. The work covered under this section shall include providing and installing complete the rooftop air handling unit as shown on the drawings and specified herein.

III. Quality Assurance
   A. The air handling unit shall have ARI certified ratings and shall be labeled as acceptable by an approved safety testing or inspection agency such as Underwriters Laboratories.
   B. The motors shall be manufactured under NEMA standards.
   C. All wiring shall conform to the National Electric Code (NEC).
   D. The coils shall have ARI certified ratings.
   E. Factory Start-up – The manufacture shall supply complete factory start-up by a factory approved start-up agent.
   F. Equipment installer shall attend a controls coordination meeting with the section 230923 contractor as described in 15900, 1.03.

IV. Submittals
   A. Provide shop drawings on this equipment as described in section 230100, 1.04. The controls coordination meeting described in 230923, 1.03 shall be held before the shop drawings are submitted.

Part 2 - Products

I. Rooftop Air Handling Unit
   A. The air handling unit shall be provided and installed complete with the type, arrangement, capacities and accessories as shown on the drawings and specified herein. Acceptable manufacturers include:
      1. Trane
      2. Carrier
      3. Daikin
      4. York

B. Casing - The housing shall be constructed of heavy sheet mill galvanized steel adequately reinforced with structural members and provided with sufficient access panels for proper lubrication and maintenance. Unit shall be of the arrangement shown on the drawings. Units shall be fully gasketed for weather protection. Piping to the roof mounted units shall be totally within the unit curb. Unit shall include one-piece, cellular insulation extending under coil and fan sections with drain connections on both sides. The double wall panels shall be two inches thick with 18 gauge mill galvanized steel outer wall and 22 gauge mill galvanized inner wall. Panels shall be individually removable for access and maintenance. The insulation shall be two inches thick fiberglass with 1.5 PCF density. Hinged, gasketed, double wall, insulated access doors shall be provided for access to all fan, filter, coil, energy recovery wheel sections and piping enclosures. Unit casing may be chemically cleaned, spray painted, baked and coated with an additional exterior coat of enamel after final assembly in lieu of mill galvanizing.

C. Fans - Shall be airfoil type. All fans shall be statically and dynamically balanced and tested after being installed in factory-assembled fan sections. Fully serviceable prelubricated 200,000 hour life ball bearings with externally mounted grease fittings shall be included on all units so bearings can be serviced without dismantling the unit. Provide internal grease tubings for servicing where applicable.

D. Motor and Drive

1. Provide belt drive with guard and adjustable motor sheave. Motor nameplate horsepower shall exceed brake horsepower by a minimum of 5% with airfoil. Provide oil resistant type belts. Provide motor especially designed for quiet operation.
2. Motor speed (for VAV units) shall be controlled by variable frequency drives. All variable frequency drives shall be factory installed by the manufacturer. See section 262923 for acceptable manufacturers.

E. Chilled Water Coil - Shall be pitched within the casing for proper drainage. It shall be the continuous aluminum plate fin and copper tube type, with drawn and belled collars mechanically expanded to seamless copper tubes. The completely drainable coil shall be tested under water at 250 psig. Provide one piece sloped, non-corrosive, cleanable stainless steel or plastic IAQ type insulated drain pan. A water level sensing device shall be provided in the unit condensate pan which will shut down the unit in the event this devices level is exceeded.

F. Hot Water Heating Coil - Shall be pitched within the casing for proper drainage. Coil shall be furnished with metering orifices in the supply header to insure equal distribution of hot

water to each tube. The coil shall be tested at 250 psig under water. The hot water coil shall be placed in a pre-heat position on chilled water systems and downstream on a DX system.

G. Energy Recovery Heat Wheel (If so equipped):
   1. Heat Wheels shall comply with UL standards.
   2. Heat Wheel - Provide aluminum or polymer transfer media, flame spread rating of not more than 25 and smoke developed rating of not more than 50 and shall be independently tested in accordance with ASTM standard E-84. Rotor media shall be independently tested in accordance with ASHRAE Standards. It shall allow laminar flow (but not radial) at usual velocities and prevent leakage, bypassing and cross contamination by cross flow within wheel. Size the transfer media to allow passage of 300 micron particles without fouling or clogging. Treat media with non-degrading desiccant that is bacteriostatic, non-corroding and non-toxic. No asbestos material will be allowed. Wheel shall not condense water directly or require a condensate drain for summer or winter operation. Performance rating shall be in accordance with ARI Standard 1060.
   3. Provide casing seals on periphery of rotor as well as on duct divider and purge section. Seals are to be adjustable, of extended life materials and effective in limiting air leakage.
   4. Wheel shall be supported by ball or roller bearings and belt driven by a fractional horsepower, totally enclosed, NEMA Standard motor through a close coupled positively lubricated speed reducer, or gear/chain speed reduction.
   5. Unit shall be constructed of heavy gage steel to insure rigidity and stability. Casing side panels shall be removable to insure easy access to internal parts. Provide integral flanges for flanged duct connection and provide lifting holes or lugs.

H. Air Dampers shall be aluminum, non-corrosive opposed blade type.

I. Outside Air Damper (for VAV units) - Provide factory installed damper/airflow monitoring assembly for maintaining a constant quantity of outside air. Assembly shall consist of factory mounted dampers that both modulate and measure airflow.

J. Filter Section - Low velocity medium capacity filter section shall be a matching part of the unit with access through hinged doors on both sides. Filters shall be 2" FARR 30/30 medium efficiency, pleated, disposable type. Each filter shall consist of a non-woven cotton fabric media, media support grid and enclosing frame. The filter media shall have an average efficiency of 30-35% on ASHRAE Test Standard 52-76. It shall have an

average arrestance of not less than 92% in accordance with that test standard. The filter shall be listed by Underwriters Laboratories as Class 2. Two complete sets of spare filters shall be supplied in addition to the set used during construction. Metal filters may be accepted pending review by PGCPS building services.

K. Vibration Isolators - Provide factory installed internal spring isolators or field installed external housed type spring isolators for all air handling units. Install external isolators in accordance with manufacturer's recommendations. Acceptable external isolator manufacturers:
   1. Mason Industries
   2. Peabody Noise Control
   3. Vibration Eliminator Company
   4. Vibration Mountings And Controls.

L. Roof Curb - Provide pre-fabricated aluminum or galvanized steel 14" high curbs to match the unit. Provide wood nailer. The curb shall be flashed to match the roofing system. The unit and curb shall be provided by the same manufacturer. Roof curbs shall be one piece; two piece curbs will not be accepted.

M. Starter - Provide magnetic line voltage starter with HAND-OFF-AUTO switch, red running light, and auxiliary contacts for all motors. See Electric Motor Starters, Section 15050. All starters shall be factory installed by the manufacturer.

N. Wiring - All units shall have single point power connections with convenience outlet. The units shall be completely pre-wired at the factory, including all motors, starters, variable frequency drives, internal transformers, actuators, and controls.

O. A water level sensing device shall be provided in the unit condensate pan which will shut down the unit in the event this devices level is exceeded. Condensate float shall be located in a readily accessible location.

P. Unit shall be provided with hail guards.

Q. Temperature Controls
   1. Shall be provided to accomplish control sequence as outlined in the automatic temperature control section of specifications. All temperature controls shall be factory installed, wired and programmed by the manufacturer or see item 3 below.
   2. Manufacturer shall provide an interface which will allow the Owner's energy management system to access the control points shown on the points list. This interface shall be in complete compliance with ANSI/ASHRAE Standard #135-2000. Provide any coordination as required to facilitate this interface into the Owner's EMS.

Provide all necessary protocol documentation and gateway hardware and software (if required) such that the section 230923 system suppliers may successfully create a communication interface between the control system furnished in this section of the specification and the 230923 control system. Provide an adequate level of technical support to guide the section 15900 personal towards completion of subject communication interface. Protocol must support reading / writing status and analog and digital point information from this section of the specification. All documentation, gateway hardware and software, and required technical support are understood to be included in the bid.

3. Unit shall be provided with freeze protection as required by Section 15900. No automatic reset freezestats will be accepted.
4. Temperature Controls shall be accomplished by either of the following methods:
   a) Factory built-in controls shall be provided to interface with the ATC to accomplish control sequence as outlined in Automatic Temperature Control section of specifications.
   b) Field installed controls provided by the division 230923 contractor is acceptable provided the control sequence as outlined in Automatic Temperature Control section of specifications is met.

      The control contractor must have the ability to interface with and control the factory supplied outside airflow monitoring assembly.

Part 3 - Execution

I. Installation

A. The air handling units shall be installed as shown on the drawings and as recommended by the manufacturer.

B. Factory Start-up – The manufacturer shall supply complete factory start-up by a factory approved start-up agent.

C. The air handling unit fan speed shall be adjusted to deliver the amount of air as stated on the drawings by adjusting the motor sheave or variable frequency drive. If the proper amount of air cannot be obtained by this adjustment, the contractor shall provide and install new motor sheave and belts to obtain the proper amount of air.

D. Provide three (3) sets of spare belts for each air handling unit.

E. Three (3) sets of spare filters shall be provided in addition to the set used during construction with each air handling unit. The filters shall be changed after the construction dust has been eliminated and before final inspection. The other set of filters shall be stored in the respective mechanical rooms or spaces.

F. Provide grease fittings extensions where necessary to have the grease fitting accessible.

G. Provide a typed list of all the different air handling units their filter sizes and their belt sizes to be included in the O&M manuals. The list shall include the unit designation, filter size and belt size the number of filters and belts required for each unit in addition to this submit to the Owner three copies of the list distributed to the PGCPS project manager of record, building supervisor, and PGCPS Building Services.

H. Warranty Tag - The Contractor shall attach an engraved weatherproof Guarantee or Warranty tag to the exterior of each unit. Identification tag shall be black with engraved 1/2 " white letters which reads:

UNIT #	*(unit number)*
INSTALLED BY:	*(contracting company's name)*
WARRANTY EXPIRES:	*(month/day/year)*
COMPRESSOR WARRANTY EXPIRES:	*(month/day/year)*

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 -General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope
   A. The work covered under this section shall include providing and installing, complete, the air handling unit as shown on the drawings and specified herein.

III. Quality Assurance
   A. The air-handling unit shall have ARI certified ratings and shall be labeled as acceptable by an approved safety testing or inspection agency such as Underwriters Laboratories.
   B. The motor shall be manufactured under NEMA standards.
   C. The coils shall have ARI certified ratings.
   D. Equipment installer shall attend a controls coordination meeting with the section 230923 contractor as described in 230923, 1.03.

IV. Submittals
   A. Provide shop drawings on this equipment as described in section 230100, 1.04. The controls coordination meeting described in 230923, 1.03 shall be held before the shop drawings are submitted.

Part 2 - Products

I. Air Handling Unit
   A. The air-handling unit shall be provided and installed complete with the type, arrangement, capacities and accessories as shown on the drawings and specified herein. Acceptable manufacturers include:
      1. Trane
      2. Carrier
      3. Daikin
      4. York.
   B. Casing - The housing shall be constructed of heavy sheet mill galvanized steel adequately reinforced with structural members and provided with sufficient access panels for proper lubrication and maintenance. Unit shall be of the arrangement shown on the

drawings. Unit shall include one piece drain pan with 1/2" foamed-in-place, cellular insulation extending under coil and fan sections with drain connections on both sides. Hinged panels in fan, coil, filter and mixing box sections shall provide access to all internal parts. All unit panels shall be insulated with 1" foil faced glass fiberboard. Unit casing may be chemically cleaned, spray painted, baked and coated with an additional exterior coat of enamel after final assembly in lieu of mill galvanizing.

C. Fans - Shall be airfoil type. All fans shall be statically and dynamically balanced and tested after being installed in factory-assembled fan sections. Fully serviceable prelubricated 200,000 hour life ball bearings with externally mounted grease fittings shall be included on all units so bearings can be serviced without dismantling the unit. Provide internal grease tubings for servicing where applicable.

D. Motor and Drive:

1. Shall be belt drive with guard and adjustable motor sheave. Motor nameplate horsepower shall exceed brake horsepower by a minimum of 5% with airfoil. Belts shall be of the oil resistant type. Motor shall be especially designed for quiet operation. Provide and install VFD Variable Frequency Drive.
2. Motor speed for VAV units shall be controlled by a variable frequency drive. All VFD's shall be factory installed by the manufacturer.

E. Chilled Water Coil - Shall be pitched within the casing for proper drainage. It shall be the continuous aluminum plate fin and copper tube type, with drawn and belled collars mechanically expanded to seamless copper tubes. The completely drainable coil shall be tested under water at 250 psig. Provide an IAQ type sloped cleanable non-corrosive one piece insulated drain pan.

F. Hot Water Heating Coil - Shall be pitched within the casing for proper drainage. Coil shall be furnished with metering orifices in the supply header to insure equal distribution of hot water to each tube. The coil shall be tested at 250 psig under water. The hot water coil shall be placed in a pre-heat position on all chilled water systems and downstream on a DX system, except for VAV type unit.

G. Mixing Box - Low Leak Dampers - The mixing box shall be a product of the air handling unit manufacturer with the arrangement as shown on the drawings. The return air and outside air dampers shall be sized for 100% air, shall be interconnected, and shall be as follows:

1. Return Air Damper - The parallel blades shall be brake formed and secured to a minimum of 5/8" diameter steel-rods rotating in nylon bushings and mounted in rigid

steel damper frames. The frame shall be constructed of a minimum 13-gauge sheet steel and the blades of a minimum double 22 gauge sheet steel.

2. Outside Air Damper - Opposed Blade - The outside air damper supplied by the air handling unit manufacturer shall not be used.

H. Filter Section - Low velocity medium capacity filter section shall be a matching part of the unit with access through hinged doors on both sides. Combination mixing box/filter sections are not acceptable. Filters shall be 2" FARR 30/30 medium efficiency, pleated, disposable type. Each filter shall consist of a non-woven cotton fabric media, media support grid and enclosing frame. The filter media shall have an average efficiency of 30-35% on ASHRAE Test Standard 52-76. It shall have an average arrestance of not less than 92% in accordance with that test standard. The filter shall be listed by Underwriters Laboratories as Class 2. Two complete sets of spare filters shall be supplied in addition to the set used during construction. Metal filters may be accepted pending review by PGCPS building services.

I. Filter Gauge - Shall be a manometer type with an operating range of 0 - 3" w.c. Furnish one for each air-handling unit.

J. Vibration Isolation - Provide factory installed internal spring isolators or field installed external housed type spring isolators for all air handling units. Install external isolators in accordance with manufacturer's recommendations. Acceptable external isolator manufacturers:

1. Mason Industries
2. Peabody Noise Control
3. Vibration Eliminator Company
4. Vibration Mountings And Controls.

K. Starter - Provide magnetic line voltage starter with HAND-OFF-AUTO switch and red running light. See Electric Motor Starters, section 230513.

L. Sound Ratings

1. The sound power rating (re: 10-12 watts) leaving the air handling unit shall meet current AHRI standards.
2. Air handling unit sound ratings shall be based on tests in a sound laboratory reverberant room strictly conforming to ASHRAE Standard 36-62, in accordance with AMCA 300 procedures. Sound data must be accurate to within + 5 db @ 63 Hz, + 4 db @ 125 Hz, + 2 db from 250-2000 Hz, + 3 db @ 4000 Hz and above.

3. Where the manufacturer's sound power data is not published, an officer of the company must certify that sound data conforms to the above requirements. If the manufacturer does not have acoustical facilities in accordance with the above requirements, the contractor must submit certified data that the specified units have been tested in an approved independent acoustics lab, capable of testing equipment at specified operating conditions, to determine sound power levels by octave band.

M. Temperature Controls:
   1. All controls shall be provided by the BAS contractor under section 15900.

N. A water level sensing device shall be provided in the unit condensate pan which will shut down the unit in the event this devices level is exceeded. Condensate float shall be located in a readily accessible location.

Part 3 - Execution

I. Installation

A. The air handling units shall be installed as shown on the drawings and as recommended by the manufacturer.

B. The air handling unit fan speed shall be adjusted to deliver the amount of air as stated on the drawings by adjusting the motor sheave. If the proper amount of air cannot be obtained by this adjustment, the contractor shall provide and install new motor sheave and belts to obtain the proper amount of air.

C. Three (3) sets of spare filters shall be provided with each unit. The filters shall be changed after the construction dust has been eliminated and before final inspection. The other set of filters shall be stored in the respective mechanical rooms or spaces.

D. Provide three (3) sets of spare belts for each air handling unit.

E. Provide grease fitting extensions where necessary to have the grease fitting accessible.

F. The mixing box dampers shall be checked by startup agent after the damper motors have been installed and before the final inspection to make sure that the dampers are closing properly.

G. Provide a typed list of all the different air handling units their filter sizes and their belt sizes to be included in the O&M manuals. The list shall include the unit designation, filter size and belt size the number of filters and belts required for each unit in addition to this submit to the Owner three copies of the list distributed to the PGCPS project manager of record, building supervisor, and PGCPS Building Services.

H. Warranty Tag - The Contractor shall attach an engraved weatherproof Guarantee or Warranty tag to the exterior of each unit. Identification tag shall be black with engraved 1/2 " white letters which reads:

UNIT #	*(unit number)*
INSTALLED BY:	*(contracting company's name)*
WARRANTY EXPIRES:	*(month/day/year)*
COMPRESSOR WARRANTY EXPIRES:	*(month/day/year)*

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 -General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope
   A. The work covered under this section shall include packaged rooftop heating and cooling units and packaged electric cooling/heating rooftop heat pump units.

III. Quality Assurance
   A. The packaged units shall have published ratings and shall be UL listed, conforms to the current International Energy Conservation Code and current ASHRAE standards.
   B. Construct gas fired heating sections in accordance with AGA safety standards and provide AGA label.
   C. Factory start-up-The manufacturer shall supply complete factory start-up by a factory approved start-up agent.
   D. Equipment installer shall attend a controls coordination meeting with the section 230923 contractor as described in 230923, 1.03.

IV. Submittals
   A. Provide shop drawings on this equipment as described in Section 230100, 1.04. The controls coordination meeting described in 230923, 1.03 shall be held before the shop drawings are submitted.

Part 2 - Products

I. Packaged Rooftop Heating And Cooling Unit
   A. The rooftop unit shall be of the type and capacity shown the drawings. Acceptable manufacturers include:
      1. Trane
      2. Carrier
      3. Daikin.
   B. Packaged Assembly: Unit shall consist of a completely assembled, piped, wired and tested unit composed of a weatherproof enclosure that is insulated with foil faced insulation having a thickness of 1” and a density of 1 pound with all edges sealed and

hinged gasketed locking access doors and, non-corrosive, sloped, cleanable insulated IAQ type condensate drain pan centrifugal blower with belt drive air handling section, low velocity throwaway filter section complete direct expansion air cooled cooling system section, single point power connection and gas fired or hot water heating section all mounted on one base with additional roof adapting components and accessories as required in this specification or as shown on the plans.

C. Enclosure: Shall be heavy gauge zinc-coated steel with baked enamel finish and shall be completely weatherized for outdoor installation.

D. Air Handling Section: Fans shall be airfoil type. All fans shall be statically and dynamically balanced and tested after being installed in factory-assembled fan sections. Fully serviceable prelubricated 200,000 hour life ball bearings with externally mounted grease fittings shall be included on all units so bearings can be serviced without dismantling the unit. Provide internal grease tubings for servicing where applicable. The motor shall have thermal overload protection.

E. Filter Section: Shall fit into integral racks inside casing. Maximum velocity through filter 350 fpm. Filters shall be throwaway, 2" thick pleated with 35% efficiency, and a MERV rating of 8. Two complete sets of spare filters shall be supplied in addition to the set used during construction.

F. Cooling Section: Shall have vibration isolated hermetic/scroll compressor(s), copper tube aluminum fin air cooled condensing coil and propeller type condenser fans direct-connected to inherently protected motors. Provide metal hail / vandal guards to protect the condenser coil fins. Complete system shall be factory de-hydrated, tested and charged. Refrigeration cycle shall include condenser and evaporator fan compressor cutouts, 24-volt transformers, and low and high pressure cutouts. Provide liquid line solenoid valves for system pump-down and compressor protection cutout with reset as required. Units rated 10 tons and above shall have 50% capacity reduction capability. Units with a cooling capacity of 54 MBH and greater shall be equipped with an economizer cycle and shall include industry standard acceptable low leakage outside air damper.

G. Hot Water and Steam Heating Coils (if required): Shall be ARI certified non-freeze type pitched within the ductwork for proper drainage. Headers shall be heavy-gauge galvanized steel. Maximum work pressure limit of coil shall be 175 psig at 400 degrees F. Coils shall be within unit or remote in ductwork as shown on plans. When in unit, piping to coils shall be within unit.

H. Heat Exchangers: Provide manufacturer's standard construction for gas-fired heat exchangers and burners, designed for minimum of 2-stage operation. Provide single gas connection.

I. Gas Controls: Provide the following controls:
   1. Redundant gas valves
   2. Intermittent pilot ignition
   3. Electronic spark ignition system
   4. High limit cutout
   5. Flame rollout switch

J. Economizer Control: Provide economizer control consisting of return and outside air dampers, outside air filter, fully modulating electric control system with enthalpy control, and adjustable mixed-air thermostat. Design system for 100% outside air capability. Provide automatic changeover through adjustable enthalpy control device. Units without economizer cycle shall have 25% motorized outside air damper. Units which are scheduled for demand ventilation shall be configured to accept a control signal from the Automatic Temperature Control system for control of the outside air damper to accomplish the demand ventilation sequence as described in division 15900.

K. Factory built-in controls shall be provided for control of the refrigeration cycle, refrigeration safeties, heating cycle, heating safeties and economizer (if applicable). The Automatic Temperature Control contractor shall furnish controls for temperature control and energy management routines. The unit manufacturer shall provide a terminal strip for control wiring terminations.

L. Accessories: Units shall include the following accessories:
   1. All units 15 tons and larger shall have vibration isolation roof curb assembly. All other units shall have vibration isolation roof curb assembly, when shown on drawings. Pre-fabricated aluminum or galvanized steel curbs 14" high shall be provided to match the rooftop unit. The curb shall be flashed to match the roofing system. Provide wood nailer. The rooftop unit and curb shall be provided by the same manufacturer. Roof curbs shall be one piece; two piece curbs will not be accepted.
   2. Units with a cooling capacity less than 54 MBH shall have two-position, motorized outside air dampers (25% minimum) and low ambient control to 0*F. Accessories shall be of the same manufacturer as the rooftop unit.
   3. Units with cooling capacities of 54 MBH or greater shall have economizer cycle and 100% barometric relief.

4. All damper actuators shall be spring return type (for loss of power). Units using means other than true spring return are not acceptable.
5. Conventional thermostat interface for connection to the automatic temperature control system.
6. Accessories shall be of the same manufacturer as the rooftop unit.
7. A water level sensing device shall be provided in the unit condensate pan which will shut down the unit in the event this devices level is exceeded. Condensate float shall be located in a readily accessible location.
8. Units with Hot Gas Reheat, provide factory mounted sensor between evaporator coil and hot gas reheat coil for connection to the ATC system. Signal to be coordinated with the Division 15900 contractor.
9. Units with Demand Control Ventilation capabilities shall be furnished with an outdoor airflow monitoring device. This device shall be compatible with the Building Automation System (BAS) such that the outdoor airflow volume shall be set in Cubic Feet per Minute (CFM) and displayed on the BAS graphics.

II. Packaged Rooftop Heat Pump Unit

A. The rooftop heat pump unit shall be of the type and capacity shown on the drawings. Acceptable manufacturers include:
   1. Trane
   2. Carrier
   3. Daikin.

B. Packaged Assembly: Conditioner shall consist of a completely assembled, piped, wired and tested unit composed of weatherproof enclosure with resealable hinged access panels, centrifugal blower with belt drive air handling section, low velocity throwaway filter section, complete direct expansion air to air reverse cycle heat pump system section completely pre-wired and interlocked and all mounted on one base with additional roof adapting components and accessories as required in this specification or as shown on plans. Roof curb shall be by the same manufacturer.

C. Enclosure: Shall be heavy gauge zinc-coated steel with baked enamel finish and shall be completely weatherized for outdoor installation.

D. Air Handling Section: Fans shall be airfoil type. All fans shall be statically and dynamically balanced and tested after being installed in factory-assembled fan sections. Fully serviceable prelubricated 200,000 hour life ball bearings with externally mounted grease fittings shall be included on all units so bearings can be serviced without dismantling the

unit. Provide internal grease tubings for servicing where applicable. The motor shall have thermal overload protection.

E. Filter Section: Shall fit into integral racks inside casing. Maximum velocity through filter 350 FPM. Filters to be throwaway type, pleated, 2" thick, 35% efficient, and a MERV rating of 8. Provide unit with 25% motorized outside air damper.

F. Heating/Cooling Section: Shall have vibration isolated hermetic compressor(s), copper type aluminum fin air cooled condenser/evaporator coil and propeller type outdoor fans direct connected to inherently protected motors. Provide metal hail / vandal guards to protect coil fins. Complete system shall be factory dehydrated, tested and charged. Refrigeration cycle control shall include condenser and evaporator fan and compressor contactors, 24-volt transformers, low and high pressure cutouts, refrigerant and charging valves, reversing valve, automatic defrost control, low ambient control, suction line accumulator, and compressor protection cutout with reset. Provide an IAQ type sloped cleanable non-corrosive insulated condensate drain pan.

G. Supplementary Electric Heating Coil: Shall be enclosed nickel-chromium wire heating element. Heating section shall contain built-in contactors, thermal cutouts, interlock relays and box, and line voltage terminal blocks with lugs. Heaters shall be UL listed.

H. Factory built-in controls shall be provided for control of the refrigeration cycle, refrigeration safeties, heating cycle, heating safeties and economizer (if applicable). The Automatic Temperature Control contractor shall furnish controls for temperature control and energy management routines. The unit manufacturer shall provide a terminal strip for control wiring terminations.

I. Pre-fabricated aluminum or galvanized steel curbs 14" high shall be provided to match the heat pump unit. The curb shall be flashed to match the roofing system. The heat pump unit and curb shall be provided by the same manufacturer. Provide wood nailer. All units shall set on curbs unless indicated differently on drawings. Roof curbs shall be one piece; two piece curbs will not be accepted.

J. A water level sensing device shall be provided in the unit condensate pan which will shut down the unit in the event this devices level is exceeded. Condensate float shall be located in a readily accessible location.

K. Units with Hot Gas Reheat, provide factory mounted sensor between evaporator coil and hot gas reheat coil for connection to the ATC system.

L. Units with Demand Control Ventilation capabilities shall be furnished with an outdoor airflow monitoring device. This device shall be compatible with the Building Automation

System (BAS) such that the outdoor airflow volume shall be set in Cubic Feet per Minute (CFM) and displayed on the BAS graphics.

III. Packaged Vav Rooftop Heating And Cooling Unit

A. The rooftop unit shall be of the type and capacity shown the drawings. Acceptable manufacturers include:

1. Trane
2. Carrier
3. Daikin.

B. Packaged Assembly: Unit shall consist of a completely assembled, piped, wired and tested unit composed of; a weatherproof enclosure with hinged gasketed locking access doors and a non-corrosive, sloped, cleanable, insulated, IAQ type condensate drain pan, centrifugal blower with belt drive air handling section, low velocity throwaway filter section, complete direct expansion air cooled cooling system section, single point power connection, and gas fired or hot water heating section all mounted on one base with additional roof adapting components and accessories as required in this specification or as shown on the plans.

C. Enclosure: Shall be heavy gauge zinc-coated steel with baked enamel finish and shall be completely weatherized for outdoor installation. The unit roof shall be cross broken and/or sloped to assure drainage. Access to compressors, controls, blower section, heating section and other items needing periodic checking or maintenance shall be through hinged access doors. All access doors shall have gaskets and provide a weather tight seal. The air handling section of the unit shall have ½ minimum non-eroding fiberglass insulation.

D. Fan Section: Fan shall have forward curved blades, belt driven with adjustable motor sheaves. Fully serviceable prelubricated 200,000 hour life ball bearings with externally mounted grease fittings shall be included on all units so bearings can be serviced without dismantling the unit. Provide internal grease tubings for servicing where applicable. The motor shall have thermal overload protection. Supply air flow modulation shall be by a factory installed variable frequency drive. (see section 15905 for acceptable drive manufacturer).

E. Filter Section: Shall fit into integral racks inside casing. Maximum velocity through filter 350 fpm. Filters shall be pleated, 2" thick rigid extended surface, 35% efficient and a MERV rating of 8 throwaway type. Two complete sets of spare filters shall be supplied in addition to the set used during construction.

F. Cooling Section: Shall have vibration isolated scroll or hermetic compressor(s), copper tube aluminum fin air cooled condensing coil and propeller type condenser fans direct-connected to inherently protected motors. Provide metal hail/vandal guards to protect the condenser coil fins. Complete system shall be factory de-hydrated, tested and charged. Refrigeration cycle shall include condenser and evaporator fan compressor cutouts, 24-volt transformers, low and high pressure cutouts, crankcase heaters, liquid line solenoid valves for system pump-down and compressor protection cutout with reset. Refrigerant shall be 410A. Units rated 10 tons and above shall have 50% capacity reduction capability. Units with a cooling capacity of 54 MBH and greater shall be equipped with an economizer cycle and shall include low leakage outside air damper.

G. Hot Water Heating Coils: Shall be ARI certified non-freeze type pitched within the ductwork for proper drainage. Headers shall be heavy-gauge galvanized steel. Maximum work pressure limit of coil shall be 175 psig at 400 degrees F. Coils shall be within unit or remote in ductwork as shown on plans. When in unit, piping to coils shall be within unit.

H. Unit shall be provided with freeze protection. Automatic reset will not be accepted.

I. Gas Fired Furnace: Provide manufacturer's standard construction for gas-fired heat exchangers and burners, designed for fully modulating operation to maintain discharge temperature. Provide single gas connection.

1. Provide gas burner with the following controls:
    a) Redundant gas valves
    b) Intermittent pilot ignition
    c) Electronic spark ignition system
    d) High limit cutout
    e) Flame rollout switch

J. Hot Gas Reheat for Dehumidification - Hot gas reheat coils, piping and fully modulating controls shall be factory installed for humidity control.

K. Economizer Control: Provide economizer control consisting of return and outside air dampers, outside air filter, fully modulating electronic control system with reference enthalpy control and adjustable mixed-air thermostat. Design system for 100% outside air capability. Provide automatic changeover through adjustable enthalpy control device. Units without economizer cycle shall have 25% motorized outside air damper.

L. Temperature Controls: Factory built-in controls shall be provided to interface with the ATC to accomplish control sequence as outlined in Automatic Temperature Control section of specifications.

1. Manufacturer shall provide a interface device which will allow the Owner's energy management system to access the control points required by the specification section 230923. Provide any coordination as required to facilitate this interface with the Owners energy management system. Provide all necessary protocol documentation and gateway hardware and software (if required) such that the section 230923 system supplier may successfully create a communication interface between the control system furnished in this section of the specification and the 230923 control system. Provide an adequate level of technical support to guide the section 230923 personnel towards completion of subject communication interface. Protocol must support reading status and analog and digital point information from this section of the specification. All documentation, gateway hardware and software, and required technical support are understood to be included in the bid.
2. Unit shall be equipped an electronic supply air discharge temperature controller with zone, return and outdoor air reset capabilities.

M. Accessories: Units shall include the following accessories:

1. All units 15 tons and larger shall have vibration isolation roof curb assembly. All other units shall have vibration isolation roof curb assembly, when shown on drawings. Pre-fabricated aluminum or galvanized steel curbs 14" high shall be provided to match the rooftop unit. The curb shall be flashed to match the roofing system. Provide wood nailer. The rooftop unit and curb shall be provided by the same manufacturer.
2. Units with a cooling capacity less than 54 MBH shall have two-position, motorized outside air dampers (25% minimum) and low ambient control to 0 deg F. Accessories shall be of the same manufacturer as the rooftop unit.
3. Units with cooling capacities of 54 MBH or greater shall have economizer cycle and 100% barometric relief. Units that incorporate a modulating power exhaust based on building static or economizer damper position are acceptable.
4. All damper actuators shall be spring return type (for loss of power). Actuators using means other than true spring return are not acceptable.
5. Provide a factory installed outside airflow monitoring device to ensure minimum outside airflow requirements are met. This device shall compensate the outside air flow in relation to supply air percentage as it increases and decreases.
6. Provide extended grease lines for all fan bearings.
7. Accessories shall be of the same manufacturer as the rooftop unit.

8. A water level sensing device shall be provided in the unit condensate pan which will shut down the unit in the event this devices level is exceeded. Condensate float shall be located in a readily accessible location.
9. Roof curbs shall be one piece; two piece curbs will not be accepted.
10. Provide factory mounted sensor between evaporator coil and hot gas reheat coil for connection to the ATC system.

Part 3 - Execution

I. Installation

A. Factory Start-up – The manufacturer shall supply complete factory start-up by a factory approved start-up agent.

B. The packaged rooftop unit shall be installed complete with all accessories in accordance with the manufacturer's recommendations, as indicated in the specifications and as shown on the drawings.

C. Three (3) sets of spare filters shall be provided with each unit. The filters shall be changed after the construction dust has been eliminated and before final inspection. The other set of filters shall be stored in the respective mechanical rooms or spaces.

D. Provide three (3) sets of spare belts for each air handling unit.

E. Provide a typed list of all the different air handling units their filter sizes and their belt sizes to be included in the O&M manuals. The list shall include the unit designation, filter size and belt size the number of filters and belts required for each unit in addition to this submit to the Owner three copies of the list distributed to the PGCPS project manager of record, building supervisor, and PGCPS Building Services.

F. Supply and return air ductwork connecting to package rooftop units setting on steel framing shall have flexible connections in the ductwork located inside the building, just below the roofline or inside of wall for horizontal discharge units. Package rooftop units setting on roof curbs which discharge horizontally shall have the flexible connection located within the building.

G. Provide two (2) sets of spare fuses for each packaged rooftop unit.

H. Warranty Tag - The Contractor shall attach an engraved weatherproof Guarantee or Warranty tag to the exterior of each unit. Identification tag shall be black with engraved 1/2" white letters which read:

UNIT #	*(unit number)*
INSTALLED BY:	*(contracting company's name)*
WARRANTY EXPIRES:	*(month/day/year)*
COMPRESSOR WARRANTY EXPIRES:	*(month/day/year)*

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 -General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope
   A. The work covered under this section shall include providing and installing complete the roof mounted makeup air unit as shown on the drawing and specified herein.

III. Quality Assurance
   A. The unit fan shall have ARI certified ratings and be UL listed.
   B. The motor shall be manufactured under NEMA standards.
   C. The coils shall have ARI certified ratings.
   D. Equipment installer shall attend a controls coordination meeting with the section 15900 contractor as described in 230923, 1.03.

IV. Submittals
   A. Provide shop drawings on this equipment as described in Section 230100 - 1.04. The controls coordination meeting described in 230923, 1.03 shall be held before the shop drawings are submitted.

Part 2 - Products

I. Roof Mounted Makeup Air Unit
   A. The roof mounted makeup air unit shall be provided and installed complete with the type, arrangement, capacities and accessories as shown on the drawings and specified therein. Direct fire type units are not acceptable. Acceptable manufacturers include:
      1. Innovent
      2. Daikin
      3. CaptiveAire.
   B. Casing – The housing shall be constructed of heavy sheet mill galvanized steel adequately reinforced with structural members and provided with sufficient access panels for proper weatherproofing, lubrication and maintenance. Unit shall be of the arrangement shown on the drawings. Provide internal piping pocket within casing to coils. Piping to the units shall be totally within the unit curb. External pipe chases, including those mounted

on the units, are not acceptable. Unit shall include one-piece, cellular insulation extending under coil and fan sections with drain connections on both sides. The double wall panels shall be two inches thick with 18 gauge mill galvanized steel outer wall and 22 gauge mill galvanized inner wall. Panels shall be individually removable for access and maintenance. The insulation shall be two inches thick fiberglass with 1.5 PCF density. Hinged, gasketed, double wall, insulated access doors shall be provided for access to fan, filter, coil, damper, and heat exchanger sections. Unit casing may be chemically cleaned, spray painted, baked and coated with an additional exterior coat of enamel after final assembly in lieu of mill galvanizing.

C. Fans - Shall be airfoil type. All fans shall be statically and dynamically balanced and tested after being installed in factory-assembled fan sections. Fully serviceable prelubricated 200,000 hour life ball bearings with externally mounted grease fittings shall be included on all units so bearings can be serviced without dismantling the unit. Provide internal grease tubings for servicing where applicable.

D. Motor and Drive - Shall be belt drive with guard and adjustable motor sheave. Motor nameplate horsepower shall exceed brake horsepower by a minimum of 5% with airfoil. Belts shall be of the oil resistant type. Motor shall be especially designed for quiet operation.

E. Isolation – Fans and motors shall be mounted on spring isolated unitary bases, flexibly connected to the unit casing.

F. Chilled Water Coil – Shall be pitched within the casing for proper drainage. It shall be the continuous aluminum plate fin and copper tube type, with drawn and belled collars mechanically expanded to seamless copper tubes. The completely drainable coil shall be tested under water at 250 psig. Provide one piece IAQ type insulated drain pan. Drain pan shall be sloped toward the condensate drain connection drain pan shall be non-corrosive and cleanable. All piping and isolation valves to coils shall be inside unit casing. Chilled water pipes exposed to the air stream shall be insulated with ¾" armaflex or equal.

G. Hot Water Heating Coil – Shall be pitched within the casing for proper drainage. It shall be the continuous aluminum plate fin and copper tube type, with drawn and belled collars mechanically expanded to seamless copper tubes. The completely drainable coil shall be tested under water at 250 psig. The hot water coil shall be placed in a pre-heat position on chilled water systems and downstream on a DX system. All piping and isolation valves

to coils shall be inside unit casing. Hot water pipes exposed to the airstream shall be insulated with ¾" armaflex or equal.

H. Heat Exchanger shall be stainless steel type.

I. Outside Air Damper – Shall be low leakage opposed blade type with 16-gauge frame and 16 gauge blades. Maximum blade width 8". Provide neoprene seals at all blade edge and side meeting surfaces so that air leakage shall be no more than 1% at 4" static pressure. Provide teflon or oil impregnated bronze shaft bearings and standard finish. Approved manufacturers include:

J. Filter Section – Low velocity medium capacity filter section shall be a matching part of the unit with access through hinged doors on both sides. Filters shall be 2" FARR 30/30, medium efficiency, pleated, disposable type. Each filter shall consist of a non-woven cotton fabric media, media support grid, and enclosing frame. The filter media shall have an average efficiency of 30-35% of ASHRAE Test Standard 52-76. It shall have an average arrestance of not less than 92% in accordance with that test standard. The filter shall be listed by Underwriter's Laboratories as Class 2. Two complete sets of spare filters shall be supplied.

K. Starter – Provide magnetic line voltage starter with HAND-OFF-AUTO switch and red running light and auxiliary contacts. See Electric Motor Starters, Section 230513.

L. Temperature Controls shall be accomplished by either of the following methods:

1. Factory built-in controls shall be provided to interface with the ATC to accomplish control sequence as outlined in Automatic Temperature Control section of specifications.
2. Field installed controls provided by the section 230923 contractor are acceptable provided the control sequence as outlined in Automatic Temperature Control section of specifications is met.

M. The control contractor must have the ability to interface with and control the factory supplied outside airflow monitoring assembly. Make up air unit shall be interlocked with kitchen exhaust hood.

N. Pre-fabricated aluminum or galvanized steel curbs 14" high shall be provided to match the roof mounted makeup air unit. The curb shall be flashed to match the roofing system. The unit and curb shall be provided by the same manufacturer. Roof curbs shall be one piece; two piece curbs will not be accepted.

O. Provide inlet hood with moisture eliminator.

P. Unit shall be provided with hail guards.

Part 3 - Execution

I. Installation

A. The roof mounted makeup air unit shall be installed as shown on the drawings and as recommended by the manufacturer.

B. The unit fan speed shall be adjusted to deliver the amount of air as stated on the drawings by adjusting the motor sheave or frequency drive. If the proper amount of air cannot be obtained by this adjustment, the contractor shall provide and install new motor sheave and belts to obtain the proper amount of air.

C. Three (3) sets of spare filters shall be provided with each unit. The filters shall be changed after the construction dust has been eliminated and before final inspection. The other set of filters shall be stored in the respective mechanical rooms or spaces.

D. Provide three (3) sets of spare belts for each air handling unit.

E. Provide grease-fitting extensions where necessary to have the grease fitting accessible.

F. Provide one set of spare fuses for each roof mounted makeup air unit.

G. Provide a typed list of all the different air handling units their filter sizes and their belt sizes to be included in the O&M manuals. The list shall include the unit designation, filter size and belt size the number of filters and belts required for each unit in addition to this submit to the Owner three copies of the list distributed to the PGCPS project manager of record, building supervisor, and PGCPS Building Services.

H. All rooftop mechanical equipment must be curb or steel frame mounted. Any equipment previously mounted on loose wooden supports laying directly on the roof's surface will be re-installed on new curb style equipment supports as shown in plans on the drawing sheet labeled Typical Details. See the State of MD DGS Chapter VII standards for New Roofing Construction, Re-Roofing Construction and Roof System Guarantee Requirements. All mechanical equipment shall be mechanically attached to equipment curbs mechanically attached to the roof structure. New equipment curbs shall be properly flashed, counter flashed and capped. All piping and electrical conduit must be firmly supported. All equipment installations must match general roofing uplift requirements. Re-installing equipment on loose lumber supports (in-kind) is not acceptable.

I. Warranty Tag - The Contractor shall attach an engraved weatherproof Guarantee or Warranty tag to the exterior of each unit. Identification tag shall be black with engraved 1/2 " white letters which reads:

UNIT #	*(unit number)*
INSTALLED BY:	*(contracting company's name)*
WARRANTY EXPIRES:	*(month/day/year)*
COMPRESSOR WARRANTY EXPIRES:	*(month/day/year)*

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 - General Requirements, Section 230100 - Mechanical General Requirements, and Section 230500 - Basic Materials and Methods shall apply to this Section.

II. Scope
   A. Install a complete factory assembled kitchen makeup air unit with an indirect gas fired preheater.

III. Quality Assurance
   A. Conform to AMCA Bulletins regarding construction and testing. Fans shall bear AMCA certified rating seal.
   B. Provide fans with U/L label. Provide furnaces design-certified by the American Gas Association (AGA) and bear the AGA label.

IV. Submittals
   A. Provide shop drawings on this equipment as described in Section 230100 - 1.04.

Part 2 - Products

I. Kitchen Make-Up Air Units
   A. Acceptable manufacturers include:
      1. CaptiveAire
      2. Greenheck
      3. RenewAire
      4. Reznor
   B. Supply Air
      1. Filtered makeup air units shall have belt driven double width/double inlet, forward curved centrifugal type supply fans. The entire fan and motor assembly shall be mounted on vibration isolators to prevent noise transmission. Motors shall be permanently lubricated, heavy duty, ball bearing type, carefully matched to the fan load and furnished at the specified voltage, phase and enclosure. The fan shaft shall be ground and polished steel mounted in heavy duty, sealed ball bearings. Bearings shall be selected for a minimum average life in excess of 200,000 hours of maximum cataloged operating speeds. Pulleys shall be of the fully machined, cast iron type, keyed and securely attached to the wheel and motor shafts. Motor

sheaves shall be adjustable for final system balancing. Drives shall be sized for a minimum of 150% of driven horsepower.

2. Fan wheels shall be of the forward curved type, constructed of heavy gauge steel and statically and dynamically balanced to ensure smooth, vibration free operation.
3. Housing construction shall be heavy gauge galvanized steel with removable panels for access to fan and tempering unit components, filters and controls.
4. Filter Section - Low velocity medium capacity filter section shall be a matching part of the unit with access through hinged doors on both sides. Filters shall be 2" FARR 30/30, medium efficiency, pleated, disposable type. Each filter shall consist of a non-woven cotton fabric media, media support grid and enclosing frame. The filter media shall have an average efficiency of 30-35% of ASHRAE Test Standard 52-76. It shall have an average arrestance of not less than 92% in accordance with that test standard. The filter shall be listed by Underwriter's Laboratories as Class 2. Two complete sets of spare filters shall be supplied.
5. The prewired control center shall include, but not be limited to, an integral master disconnect switch with fuse blocks for main power connection, magnetic motor starters with thermal overloads and manual reset, fused 115 volt control transformer, and distribution terminal control strip for control wiring connection. All electrical components shall be U/L listed, Approved or Classified where applicable and wired in compliance with the National Electrical Code. Wiring shall be complete, requiring only one-point field connection for power service and one-point field connection for low voltage.

C. Exhaust:

1. Roof exhaust fans shall be of the belt drive, upblast, vertical discharge type. Housings shall be constructed of heavy gauge aluminum. The windband shall have a rolled bead and additional structural members for added strength. The fan wheel shall be of the backward inclined, centrifugal type, constructed of aluminum and statically and dynamically balanced for smooth, vibration free operation.
2. Motors and drives shall be isolated from the airstream. Motors shall be permanently lubricated, heavy duty, ball bearing type, carefully matched to the fan load and furnished at the specified voltage, phase and enclosure. Motors shall be cooled by air drawn from outside the exhaust airstream.

3. The fan shaft shall be ground and polished steel mounted on heavy duty ball bearings. Bearings shall be selected for a minimum average life in excess of 200,000 hours at maximum cataloged operating speeds.
4. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to the wheel and motor shafts. Motor sheaves shall be adjustable for final system balancing. Drives shall be sized for a minimum of 150% of driven horsepower. The entire fan and motor assembly shall be mounted on vibration isolators to prevent noise transmission.
5. The roof exhaust fans shall bear the AMCA certified ratings seals for air and sound performance.

D. Heater:
1. Provide an indirect gas fired preheater. The preheater shall be supplied as an integral part of the makeup air unit.
2. The heater shall include, but not be limited to, a cast iron and stainless steel burner, gas valve with sensor, main and pilot electric gas valves and pressure regulators, main and pilot manual shutoff valves, an air flow switch, high limit control, flame safeguard control, flame rod, and electronic ignition pilot.

E. Roof Curb: Provide prefabricated 12" roof curb lined with fiberglass insulation. Provide heavy gauge galvanized steel equipment supports.

Part 3 - Execution

I. Installation
A. Supply and install sheaves as necessary for final air balancing.
B. Set roof mounted fans on curbs. Provide acoustic insulation on duct to below roof line and on fan inlet plenum, and drip pan for collecting condensation.
C. Provide a spare fan belt for each makeup air unit.
D. Provide a typed list of all the different makeup air units and their filter and fan belt sizes and submit to the Owner two copies of the list distributed to the PGCPS project manager of record and PGCPS building services. Include list in the Operation and Maintenance manuals.

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 -General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope
   A. Furnish permanently installed electric cooling/hot water packaged terminal air conditioner of size and capacity shown on drawing. Conditioner shall consist of a room cabinet-wall sleeve, Heating/Cooling chassis, control module, and outside air louver.

III. Quality Assurance
   A. The packaged units shall have published ratings and be listed by Underwriters Laboratories.

IV. Submittals
   A. Provide shop drawings on this equipment as described in Section 230100 - 1.04.

Part 2 - Products

I. Packaged Terminal Unit
   A. The thru-wall unit shall be of the type and capacity shown on the drawings. Acceptable manufacturers include:
      1. Amana
      2. Trane
      3. Daikin
      4. Carrier.
   B. Outside Air Louver - Shall be anodized extruded aluminum with finish selected by Architect. Louver shall be easily installed from inside of building.
   C. Room Cabinet-Wall Sleeve - Shall be entirely constructed of zinc-coated, phosphatized steel. Top and sides shall be 18 gauge with baked epoxy corrosion resistant finish. Base pan shall be 16 gauge dipped in thermo-setting plastic, epichlorhydrin bisphenol, and baked to form a continuous film of corrosion protection. Discharge grilles shall be four-position stamped aluminum. Front panel shall be capable of being opened and/or removed without the use of tools.

D. Heating-Cooling Chassis - Shall be a slide-in, plug-in chassis with self-contained refrigerant cycle consisting of compressor, condenser fan and coil, evaporator fan and coil, hot water coil, refrigerant tubing and controls, electrical and operating controls, pressure ventilation system and condensate removal system.
   1. Compressor shall be welded hermetic, internally and externally vibration isolated. Refrigeration control shall provide full cooling capacity at ambient temperatures down to 35 degrees F without evaporator coil freeze-up, compressor short-cycling or slugging. Refrigerant shall be 410A.
   2. Evaporator and condenser fans shall be driven by one two-speed, permanent split capacitor, permanently lubricated fan motor located in conditioned air stream.
   3. Heating coil shall be serpentine hot water type. The coil shall be constructed of aluminum fins mechanically bonded to seamless copper tubes with continuous fin collars and sleeved coil and supports. Coils shall be factory tested at 300 psi. Provide supply and return gate valves, automatic air vents and drain plugs. Provide hailguard at coils.

E. Operating Controls - Shall be provided in a separable, plug-in module as part of the cooling chassis. Control module shall consist of self-contained adjustable thermostat, with OFF-HEAT-COOL-HIGH-LOW selector switches.

Part 3 - Execution

I. Installation
   A. The packaged unit shall be installed complete with all accessories in accordance with the manufacturer's recommendations and as shown on the drawings.
   B. New filters shall be installed after construction is over and before the final inspection.
   C. Provide a typed list of all the different units and their filter sizes to be included in the O&M manuals. In addition to this, submit to the Owner two additional copies of the list, distributed to the PGCPS project manager of record and PGCPS building services.

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 - General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope
   A. Provide and install complete the Remote Air Cooled Condensing Units as shown on the drawing and specified herein.

III. Quality Assurance
   A. The combined systems shall comply with ARI Standard 210.
   B. Both the air handling unit and the air cooled condensing unit shall be Underwriters Laboratories listed and bear the UL label.
   C. Equipment installer shall attend a controls coordination meeting with the Section 15900 contractor as described in 15900.

IV. Submittals
   A. Provide shop drawings on all piping and fittings as described in Section 230100 - 1.04.

Part 2 - Products

I. Air Cooled Condensing Unit
   A. The air cooled condensing unit shall be provided and installed of the type and capacities as shown on the drawings and specified herein. The matching systems shall be manufactured by the manufacturer shown on the drawings. Acceptable manufacturers include:
      1. Trane
      2. Carrier
      3. Daikin
      4. York.

II. Condenser
   A. Air cooled condenser coils shall have aluminum fins mechanically bonded to seamless copper tubes, cleaned, dehydrated, sealed, leak tested at 150 psig and pressure tested at 450 psig.

B. Condenser fans shall be propeller type with PVC coated steel wire safety guards, balanced statically and dynamically, and shall discharge vertically.

C. Condenser fan motors shall have inherent overcurrent protection.

D. Provide metal hail guards to protect the condenser coil from damage.

E. Compressors - Shall be scroll hermetic type with a maximum speed of 3500 rpm, or rotary screw, serviceable and shall have an automatically reversible oil pump and operating oil charge. Compressors shall be equipped with suction and discharge shutoff valves and shall be mounted on individual spring vibration isolators. Each compressor motor shall be cooled by suction gas passing around the motor windings and shall be thermally protected with manual restart after thermal or pressure overload stoppage. Each compressor shall be equipped with an insert type crankcase heater to control oil dilution during shutdown. Cycles per hour per compressor shall not exceed six.

F. Refrigeration Circuit - Each refrigeration circuit shall include: hot gas muffler, combination moisture indicator and sight glass, replaceable core refrigerant filter drier, liquid line solenoid valve, expansion valve, suction and discharge pressure gauges with manual shutoff valves, high side pressure relief device, and charging valve.

G. Controls

1. Unit controls, including microprocessor, shall be factory mounted and wired in a weatherproof enclosure with hinged access doors for easy access. The controls shall include automatic lead-lag except where noted, pumpdown at beginning and end of every circuit cycle, loss-of-charge protection, inherent low water flow protection, low chilled water temperature safety, low- and high-suction superheat protection, low oil pressure protection for each circuit, ground current protection for each compressor, low control voltage to unit, current limit, field power and control circuit terminal blocks, compressor and fan motor circuit breakers, ON/OFF switch, replaceable relay board, individual solid-state compressor protection board, leaving chilled water set point board, diagnostic digital display module, a microprocessor board and a temperature reset board. The chiller shall be capable of sending a chill water pump run request to the building automation system.
2. Unit control capacity is based upon leaving water temperature and will be compensated by return water temperature.
3. Minimum number of capacity control steps shall be as shown in the equipment schedule.
4. Provide a definite purpose magnetic contactor for each compressor.

5. Calibrated circuit breakers shall be factory installed for each compressor, shall be manual reset and ambient insensitive, and shall open all three phases should an overload occur on any phase.
6. Unit primary electrical power supply shall be connected to a single point with lugs sized for specified conductors.
7. Control voltage shall be provided by a factory installed integral control transformer.
8. Heat tracing for exterior piping shall be provided by a separate 120 volt, single phase power supply.
9. Provide a barrel freeze alarm output for connection to the BAS.

H. Condenser shall be capable of operating at ambient air temperatures down to 0 deg F without the use of glycol or any other type of antifreeze. Condensers that do not meet this requirement are not acceptable.

I. Flow switches- switches for flow conformation shall be provided. Switches shall be paddle type with stainless steel bellows and paddle. Switches shall be suitable for outdoor installation.

Part 3 - Execution

I. Factory Start-up- The manufacturer shall supply complete factory start-up by a factory approved start-up agent.

II. Installation - The chiller shall be installed in accordance with the manufacturer's recommendations.

III. Install isolation valves on evaporator water inlet and outlet at chiller.

IV. Install thermometers on evaporator water inlet and outlet at chiller.

V. Isolation - Provide spring isolators as recommended by chiller manufacturer.

VI. Pipe Connections - The machine shall have water boxes or the contractor shall provide flanged pipe connections in the piping adjacent to the machine to allow removal of headers for inspection, cleaning or removal of tubes.

VII. Provide an engraved nameplate permanently affixed to the front of the control cabinet (inside of cabinet for outdoor locations) with the following information.

UNIT #	*(unit number)*

INSTALLED BY:	*(contracting company's name)*
WARRANTY EXPIRES:	*(month/day/year)*
COMPRESSOR WARRANTY EXPIRES:	*(month/day/year)*

END OF SECTION

Part 1 - General

I. General

A. The Bidding and Contract Requirements, Division 1 -General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope

A. The work covered under this section shall include the following:

1. Complete mini-split system including equipment, piping, and controls. System shall be a mini-split air conditioning system or heat pump sytem. The system will utilize an air cooled condensing/heat pump type unit supplying a maximum of four indoor fan coil units with combinations of outdoor units 1 - 15 ton capacity at one time for 208-230V/ 3 Phase service.
2. The mini-split system shall be a cooling only air conditioning system or cooling and heating heat pump system. The mini-split system shall consist of an outdoor unit, high efficiency unit designed for minimum piping and maximum design flexibility, indoor units, and controls by the equipment manufacturer. Indoor units shall be capable of operating in either heating or cooling only depending on the cycle setting of the outdoor unit.
3. The mini-split system piping system shall be designed by a manufacturer's certified designer. If Basis-of-Design system is not used, contractor shall submit fully revised piping layout to engineer, complete with revised locations and quantities of units. Revised piping layout shall be submitted with equipment submittal for review and approval by engineer. Revised piping layout shall not affect performance of indoor or outdoor units. The contractor is responsible for all costs associated with additional review required by engineer.
4. The mini-split system piping system shall be installed by a manufacturer's certified contractor with a minimum of 10 years of successful system installations. Installer shall be approved by PGCPS prior to construction.
5. The installing contractor shall be trained and certified at the manufacturer's training facility prior to installation, start-up, and commissioning. Submit for review the installation contractor's certification from the manufacturer. This certification shall include the company certification as well as certifications for each individual contractor which will be working on this project.

6. The refrigeration piping system shall be provided, installed, tested, evacuated, and charged.

III. Quality Assurance

A. Manufacturers Field Service - Engage a factory-authorized service representative to inspect field assembled components and equipment installation, including connections, and to assist in field testing.

B. The units shall be listed by Electrical Laboratories (ETL) and bear the ETL label. All wiring shall be in accordance with the National Electrical Code (NEC). The units shall be manufactured in a facility registered to ISO 9001 and ISO14001.

C. The refrigeration piping system shall be provided, installed, tested, evacuated and charged in accordance with the manufacturer's recommendations, ANSI, ASHRAE, and ARI's Safety Code for Mechanical Refrigeration, state and local codes.

D. Perform the following field tests and inspections and prepare test reports:

1. Leak Test - After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test - After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Remove and replace malfunctioning units and retest as specified above.

F. Equipment installer shall attend a controls coordination meeting with the Section 230923 contractor.

IV. Submittals

A. Provide shop drawings on this equipment as described in Section 15010, 1.04. The controls coordination meeting described in 230923 shall be held before the shop drawings are submitted.

Part 2 - Products

I. Manufacturers

A. Manufacturers - Provide products by one of the following:

1. Daikin
2. Mitsubishi
3. Samsung
4. Carrier

B. Coordinate any changes from the basis of design with all associated trades. Any additional costs associated with the alternate equipment shall be covered by the equipment manufacturer. No additional costs shall be incurred by the Owner.

II. Refrigerant Components

A. The equipment specified in this section shall operate with refrigerant R410A - no exceptions or substitutions.

B. The system shall utilize fully modulating electronic expansion valves.

C. Refrigerant Piping

1. The refrigerant piping system shall be provided complete and installed in accordance with the manufacturer's recommendations and as specified herein and the requirement of 232300. The size of the refrigerant pipes shall be obtained from the equipment manufacturer unless otherwise shown on the drawings.
2. Pipe, Fittings, and Accessories - The pipe shall be type ACR 'L' copper refrigerant tubing with hard wrought copper fittings. Pipe sized ½ inch and larger shall be hard drawn. Pipe sized 3/8 inch and smaller can either be hard or soft drawn. All of the joints shall be brazed with a filler material that complies with AWS classification BCuP-5. Use type 'L' copper tubing to pipe the relief valve discharge to the outside.
3. Condensate Drain Piping - Shall be type 'L' copper tubing.
4. Pipe Hangers and Supports - Shall be as required in Section 230500.
5. All refrigerant lines shall be insulated from the outdoor unit to the indoor terminal units as shown in Section 230700.
6. The system shall be capable of operating with refrigerant piping lengths as specified by equipment manufacturer, without any oil traps or additional equipment. The vertical difference shall not exceed a maximum of 100 feet where the outdoor unit is located below the indoor unit.

III. Heat Pump/Condensing Unit

A. The outdoor unit will have air cooled heat exchange coils constructed from copper tubing with aluminum fins. The coils will be set in a vertical formation with air being drawn in through three sides of the unit and discharged out of the top of the unit. The systems will have fan(s) mounted adjacent to the coils.

B. The outdoor unit will have one inverter controlled hermetic compressor. The system shall use a control sequence to ensure that indoor loads are matched to compressor capacity control.

C. The refrigeration process of the outdoor unit will be maintained by pressure and temperature sensors controlling solenoid valves check valves and bypass valves. The heating or cooling mode of the outdoor unit will be controlled using a combination of two- and three-way valves which will reverse the cycle of the refrigerant to change the mode of the outdoor unit.

D. The mini-split heat pump/air conditioning system shall consist of 1-4 evaporators using PID control and inverter driven outdoor unit. The unit shall consist of direct expansion (DX), air-cooled heat pump air conditioning system, variable speed driven compressor single zone split system. The outdoor unit may connect an indoor evaporator capacity of 50-130% to that of the outdoor condensing unit capacity. Each indoor unit shall be capable of operating separately with individual temperature control.

E. The outdoor unit shall be interconnected to indoor unit types specified in this section. The indoor units shall be connected to the outdoor units utilizing the specialized piping joints and headers provided by the equipment manufacturer.

F. General - The outdoor unit is designed specifically for use with manufacturers components:

1. Refrigerant: R410A.
2. The outdoor unit shall be factory assembled and pre-wired with all necessary electronic and refrigerant controls. The refrigeration circuit of the condensing unit shall consist of a compressor, motors, fans, condenser coil, electronic expansion valve, solenoid valves, four-way valve, distribution headers, capillaries, filters, shut off valves, oil separators, service ports, liquid receivers and accumulators.
3. Both liquid and suction lines shall be individually insulated between the outdoor and indoor units.
4. The outdoor unit shall be wired and piped with outdoor unit access from left, right, rear, or bottom.
5. The connection ratio of indoor units to outdoor unit shall be 50% to 130%.
6. The outdoor unit shall have a sound rating no higher than 63 dB(A).
7. The system shall automatically restart operation after a power failure and shall not cause any settings to be lost, thus eliminating the need for re-programming.
8. The outdoor unit shall be modular in design and should allow for side-by-side installation with minimal spacing.
9. The following safety devices shall be included on the condensing unit: high pressure switch, crankcase heaters, high pressure switch, overload relay, inverter

overload protector, thermal protectors for compressor and fan motors, and over current protection for the inverter. To ensure the liquid refrigerant does not flash when supplying to the various fan coil units, the circuit shall be provided with a sub-cooling feature. Oil recovery cycle shall be automatic, occurring one hour after system start up, every six hours of system operation or as required to maintain oil levels at the system condensing unit.

10. Heat pump type outdoor units shall operate in heating mode to -4F dry bulb ambient temperature without additional ambient controls.

G. Unit Cabinet - The outdoor unit model shall be completely weatherproof and corrosion resistant. The outdoor unit will be constructed from steel plate and treated with acrylic paint, or galvanized steel, bonderized and finished with a powder coated baked enamel. Provide outdoor unit with hail guards for exposed fins (HailStop Hail Guard Netting, or equal as approved by PGCPS).

H. Fan

1. The condensing unit shall consist of a propeller type, direct-drive fan motor that has multiple speed operation via a DC inverter.
2. The fan motors shall have inherent protection and permanently lubricated bearings and be mounted.
3. The fan motors shall be provided with a fan guard to prevent contact with moving parts.

I. Condenser Coil - The condenser coil shall be manufactured from copper tubes expanded into aluminum fins to form a mechanical bond.

J. Compressor

1. The compressor shall be variable speed control capable of changing the speed to follow the variations in total cooling load as determined by the suction gas pressure as measured in the condensing unit.
2. The inverter driven compressor in each condensing unit shall be a high efficiency DC, hermetically sealed compressor.
3. The capacity control range shall be a minimum of 20% to 100% of total capacity.
4. Each compressor shall be equipped with a crankcase heater, high pressure safety switch, and internal thermal overload protector.
5. Oil separators shall be standard with the equipment together with an oil balancing circuit.
6. The compressor shall be mounted to avoid the transmission of vibration.

K. Electrical

1. The power supply to the outdoor unit shall be 208/230 volts, 3 phase, 60 hertz with a voltage range of 187 volts to 253 volts.
2. The control wiring shall be a two-wire multiplex transmission system, making it possible to connect multiple indoor units to one outdoor unit with one 2-cable shielded communications wire.

IV. Indoor Air Handling Units

A. It shall be possible for the total connected capacity of the indoor units to be between 50 and 130% of the capacity of the outdoor unit.

B. Each indoor unit will have a heat exchanger which shall be constructed from copper tubing with aluminum fins. The flow of refrigerant through the heat exchanger will be controlled by an electronic proportional expansion valve. This valve will be controlled by two pipe thermistors, a return air and discharge air thermistor and shall be capable of controlling the variable capacity of the indoor unit between 25% and 100%.

C. Each indoor unit shall have an operating voltage of 208-230V/1 phase/60Hz. The indoor unit shall supply demand capacity information to the outdoor unit via its control algorithm.

D. Indoor units shall not be the primary source of dehumidification in a large capacity designed space (classrooms, etc.), nor should indoor units be the primary source of ventilation. A DOAS or outside air processing unit shall be installed in conjunction with a variable refrigerant flow system.

E. Unconditioned outside air shall not be directly introduced to indoor units. Indoor units providing ventilation shall be supplied from a DOAS or outside air processing unit.

F. Four (4) Way Ceiling Cassette Indoor Unit

1. The indoor unit shall be a ceiling cassette fan coil unit for installation into the ceiling cavity equipped with an air panel grille to be connected to indoor unit as scheduled and specified in this section. The indoor unit shall have a four-way air distribution type, impact resistant and washable decoration panel. The supply air shall be distributed via motorized louvers which can be horizontally and vertically adjusted from 0 degree to 90 degree angle.
2. Construction
   a) The indoor unit shall be completely factory assembled and tested. The unit shall include factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, condensate drain pan,

self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.

b) The 4-way supply airflow shall be field modifiable to 3-way and 2-way airflow to accommodate various installation configurations including corner installations.

c) Return air shall be through the concentric panel, which shall include a filter.

d) The indoor unit shall be equipped with a condensate pan.

e) The indoor unit shall be equipped with a return air thermistor.

f) The indoor unit shall be separately powered with 208-230V/1 phase/60Hz.

g) The voltage range shall be 253 volts maximum and 187 volts minimum.

h) The indoor unit shall be equipped with a condensate pump capable of providing at least 19" of lift.

3. Unit Cabinet

a) The cabinet shall be space saving and shall be located into the ceiling.

b) The airflow of the unit shall have the ability to shut down one or two sides allowing for simpler corner installation.

c) Provide fresh air intake kit where used and indicated on the drawings. A branch duct knockout shall exist for branch ducting supply air.

4. Fan

a) The fan shall be direct-drive turbo fan type with statically and

b) dynamically balanced impeller with high and low fan speeds available.

c) The indoor unit shall operate with a power supply of 208/230 volts, 1 phase, 60 hertz. The allowable voltage range shall be 187 to 253 volts.

d) The airflow rate shall be adjustable and have high, medium and low fan settings.

e) The fan motor shall be thermally protected.

5. Filter - The return air shall be filtered by means of a long-life filter.

6. Coil

a) Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.

b) A condensate pan shall be located under the coil. The condensate pan shall have a built in high level safety alarm to shut down the unit.

c) A thermistor shall be located on the liquid and gas line.

G. One (1) Way Ceiling Cassette Indoor Unit

1. The indoor unit shall be a ceiling cassette fan coil unit for installation into the ceiling cavity equipped with an air panel grille to be connected to indoor unit as scheduled and specified in this section. The indoor unit shall have a one-way air distribution type, impact resistant and washable decoration panel. The supply air shall be distributed via motorized louvers which can be horizontally and vertically adjusted from 0 degree to 90 degree angle.
2. Construction
   a) The indoor unit shall be completely factory assembled and tested. The unit shall include factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, condensate drain pan, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
   b) Return air shall be through the concentric panel, which shall include a filter.
   c) The indoor units shall be equipped with a condensate pan.
   d) The indoor units shall be equipped with a return air thermistor.
   e) The indoor unit shall be separately powered with 208-230V/1 phase/60Hz.
   f) The voltage range shall be 253 volts maximum and 187 volts minimum.
   g) The indoor unit shall be equipped with a condensate pump capable of providing at least 23" of lift.
3. Unit Cabinet
   a) The cabinet shall be space saving and shall be located into the ceiling.
   b) Provide fresh air intake kit where used and indicated on the drawings. A branch duct knockout shall exist for branch ducting supply air.
4. Fan
   a) The fan shall be direct-drive fan type with statically and dynamically balanced impeller with high and low fan speeds available.
   b) The indoor unit shall operate with a power supply of 208/230 volts, 1 phase, 60 hertz. The allowable voltage range shall be 187 to 253 volts.
   c) The airflow rate shall be adjustable and have high, medium and low fan settings.
   d) The fan motor shall be thermally protected.
5. Filter - The return air shall be filtered by means of a long-life filter.
6. Coil

a) Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
b) A condensate pan shall be located under the coil. The coil in the condensate pan shall have a built in high level safety alarm to shut down the unit.
c) A thermistor shall be located on the liquid and gas line.

V. Controls
A. The units shall have controls provided with the unit by the manufacturer to perform input functions necessary to operate the system.
B. Computerized PID control shall be used to maintain room temperature within 1F of setpoint.

VI. Controllers
A. Physical Characteristics - The control system shall be a neutral color plastic material with a Liquid Crystal Display (LCD).
B. Electrical Characteristics
1. General - From each circuit board to the controls, the electrical voltage shall be 16 - 24 volts DC.
2. Wiring: Control wiring shall be installed in a daisy chain configuration from indoor unit to indoor unit then to the outdoor unit. Control wiring shall run from the indoor unit terminal block to the specific controller for that unit.
3. Wiring Size: The wire shall be a shielded, size AWG16-2 or AWG 18-2.
C. Individual Zone Controller
1. The simplified wired remote controller shall be able to control 1 group (maximum of 16 fan coil units).
2. The simplified wired remote controller shall have the following features:
a) Operation - Start/Stop, Operation Mode, Temperature Setting, 60F - 90F Set Point Range, Fan Speed, Airflow Direction.
b) Monitoring - Status, malfunction flashing, malfunction content, filter sign, operation mode, temperature setting, permit/prohibit selection, fan speed, airflow direction.
c) Scheduling - ON/OFF Timer.
d) Control Management - Field Setting Mode, Group Setting, Auto Restart.
D. Centralized Controller
1. The Centralized Controller shall be capable of controlling a maximum of 8 indoor units across one outdoor unit. Centralized controller shall have a color LCD

touch-screen. The Centralized Controller shall support system configuration, daily/weekly scheduling, monitoring of operation status, night setback settings, free contact interlock configuration and malfunction monitoring. The Centralized Controller shall have five basic operation controls which can be applied to an individual indoor unit, a group of all associated indoor units (collective batch operation). This basic set of operation controls for the Centralized controller shall include on/off, operation mode selection (cool, heat, auto, dry, and fan), temperature setting, fan speed setting, and airflow direction setting. The Centralized Controller shall allow the user to define both daily and weekly schedules with operations consisting of ON/OFF, mode selection, temperature setting, air flow (vane) direction, fan speed, and permit/prohibit of remote controllers.

E. BACnet Interface to Building Automation System

1. The cooling and heating BACnet7 interface shall be compliant with BACnet7 Protocol (ANSI/ASHRAE 135-2004) and be Certified by the (BTL) BACnet7 Testing Laboratories. The BACnet7 interface shall support BACnet Broadcast Management (BBMD). The BACnet7 interface shall support a maximum of 8 indoor units. Operation and monitoring points include, but are not limited to, space temperature, space temperature setpoint, on/off, operation mode, fan speed, prohibit remote controller, filter sign reset, alarm state, error code and error address.

F. Control Panel

1. This contractor shall deliver the components of the centralized controllers and the BACnet interface devices to the Division 238923 contractor. It is the responsibility of the Division 238923 contractor to construct the control panel, housing these components in compliance with 238923 specification 2.02F.

G. Indoor Unit Sequence of Operations

1. On/Off Control - the indoor units shall be commanded ON/OFF by the BAS. If all indoor units are off, the outdoor unit shall turn off. With the Night Setback Function/Mode, the system shall cycle on during unoccupied periods as needed to maintain unoccupied temperature setpoint of 55°F (adjustable).
2. Space Temperature Control - the indoor unit shall modulate its internal linear expansion valve (LEV) to maintain the temperature setpoint via the indoor unit's internal controls.
    a) The setpoint is provided and adjustable through the BAS interface.

b) The temperature setpoint provided through the BAS interface shall additionally be adjustable to a maximum of ±2°F from that setpoint using the room controller.

3. Mode Control
   a) Auto Mode
      (1) The indoor unit shall determine whether it should be in auto-heat mode or auto-cool mode based on space temperature relative to temperature setpoint. If the indoor unit is in auto-heat mode, the indoor unit control board shall follow the heat mode sequence. If the indoor unit is in auto-cool mode, the indoor unit control board shall follow the cool mode sequence.
      (2) The indoor unit shall switch from auto-heat to auto-cool when the space temperature rises above and remains above the temperature setpoint plus the dead band for 3 minutes.
      (3) The indoor unit will switch from auto-cool to auto-heat when the space temperature drops below and remains below the temperature setpoint minus the dead band for 3 minutes.
   b) Heating Mode - the indoor unit shall modulate its linear expansion valve (LEV) to maintain temperature setpoint of 71°F (adjustable).
   c) Cooling Mode - the indoor unit shall modulate its linear expansion valve (LEV) to maintain temperature setpoint of 74°F (adjustable).

Part 3 - Execution

I. Installation
   A. Install all piping, fittings, and insulation to meet manufacturers requirements. Install units level and plumb. Condenser fan components shall be installed using manufacturer's standard mounting devices securely fastened to building structure (Thybar TEMS or approved equal). Install and connect refrigerant tubing and fittings. Pipe penetrations through the roof shall be installed with a pipe curb assembly (Thybar TCC or approved equal).
   B. Installer shall supply isolation ball valves for zoned refrigerant isolation. Installer shall supply Isolation ball valves with Schrader connection for isolating refrigerant charge and evacuation at each connected air handling unit and condensing unit. Isolation ball valves, with Schrader connection, are required for instances of air handling unit isolation for troubleshooting, repair, or replacement without affecting the remainder of

the system. Isolation ball valves with Schrader connection are also required at condensing unit connection to isolate unit for troubleshooting, repair or replacement and as required to provide partial capacity Heating/Cooling in the instance of a failure of one of the multiple outdoor unit (condensing unit) compressors.

C. During brazing an inert gas (such as nitrogen) shall be continuously passed through the system at a rate sufficient to maintain an oxygen free environment to prevent the formation of copper oxide scale. After piping has been completed, the refrigerant piping system shall be pressure tested at a pressure of 300 psi on the high side and 150 psi on the low side. The pressure shall be maintained on the system for a minimum of 24 hours. The system shall be evacuated when the surrounding ambient air is not less than 60 F. If the temperature is less, auxiliary heat must be provided to insure proper evacuating conditions. A minimum vacuum of 300 Microns of Hg. shall be pulled on the system and maintained for 24 hours. The vacuum pump displacement shall be not less than 2 cfm for up to 15 tons. The system shall be charged as recommended by the equipment manufacturer.

D. Electrical wiring required by this section, both high and low voltage, shall comply with the Division 16 requirements.

E. Start Up - Engage manufacturer or factory-authorized service representative to perform startup service. Manufacturer shall provide on-site startup and commissioning assistance through job completion. Complete installation and startup checks according to manufacturers written instructions. This shall include a factory startup for factory provided control devices as well as configuring control points for other DO devices. Service representative shall completely configure all control devices and establish remote internet connectivity with the owner's energy management department web server.

F. Demonstration - Engage manufacturer or factory-authorized service representative to demonstrate and instruct the owner's maintenance personnel of the operation and functionality of the system.

G. Training - Engage manufacturer or factory authorized service representative to train owner's maintenance personnel for a period of 2 days, to adjust, operate and maintain individual units and complete system. This shall also include training of the owner's energy management department representatives as to establish control system programming, scheduling routines, alarm reporting, system topography, communication

protocols and password level assignments. This training shall take place on-site and at the owner's maintenance facility.

H. The indoor air handling and outside condensing units shall be installed in accordance with the manufacturer's recommendations and as shown on the drawings. The first unit installed will be considered the typical mock up and shall require notification, inspection and approval by the designated owner representative and/or architect and engineer before any additional installations will be allowed.

I. Provide laminated as built drawings and manufacturer's refrigeration piping layout showing typical layout of the system. This shall include the actual room numbers, not from construction documents, and addressing scheme. Laminate shall have minimum thickness of 10 mil. Drawing size shall be 11"x17". Provide multiple drawings should zones not fit into one page.

J. Refrigerant distribution (BC) controllers shall include a label affixed to the controllers which identifies the room or rooms served for each line set on the controller. Use the actual room numbers and not from construction documents.

K. Provide a typed list of all the different units, their filter sizes, and belt sizes to be included in the O&M manuals. The list shall include the unit designation, filter size, belt size, and the number of filters and belts required for each unit. In addition to this, submit to the Owner two additional copies of the list, distributed to the PGCPS project manager of record and PGCPS Building Services.

L. Warranty Tag - The Contractor shall attach an engraved weatherproof Guarantee or Warranty tag to the exterior of each condensing unit. Tag is to be screwed or riveted to unit. Identification tag shall be black with engraved 3" white letters which reads:

UNIT #	*(unit number)*
INSTALLED BY:	*(contracting company's name)*
WARRANTY EXPIRES:	*(month/day/year)*
COMPRESSOR WARRANTY EXPIRES:	*(month/day/year)*

END OF SECTION

Part 1 - General

I. General

A. The Bidding and Contract Requirements, Division 1 -General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope

A. The work covered under this section shall include the following:

1. Complete variable refrigerant flow system including equipment, piping, and controls. System shall be a VRF (variable refrigerant flow) multi split air conditioning system. The system will utilize an air cooled condensing unit supplying a maximum of forty indoor fan coil units with combinations of outdoor units 3 - 25 ton capacity with a maximum of 2 outdoor units connected at one time for 208-230V/ 3 Phase service.
2. The VRF (Variable Refrigerant Flow) system shall be a simultaneous cooling and heating heat pump system. The VRF system shall consist of an outdoor unit, high efficiency heat recovery units designed for minimum piping and maximum design flexibility, indoor units, and controls by the equipment manufacturer. Each indoor unit shall be independently capable of operating in either heating or cooling mode regardless of the mode of other indoor units.
3. The variable refrigerant flow system piping system shall be designed by a manufacturer's certified designer. If Basis-of-Design system is not used, contractor shall submit fully revised piping layout to engineer, complete with revised locations and quantities of heat recovery units. Revised piping layout shall be submitted with equipment submittal for review and approval by engineer. Revised piping layout shall not affect performance of indoor or outdoor units. The contractor is responsible for all costs associated with additional review required by engineer.
4. The variable refrigerant flow system piping system shall be installed by a manufacturer's certified contractor with a minimum of 10 years of successful system installations. Installer shall be approved by PGCPS prior to construction.
5. The installing contractor shall be trained and certified at the manufacturer's training facility prior to installation, start-up, and commissioning. Submit for review the installation contractor's certification from the manufacturer. This certification shall

include the company certification as well as certifications for each individual contractor which will be working on this project.

6. The refrigeration piping system shall be provided, installed, tested, evacuated, and charged.

III. Quality Assurance

A. Manufacturers Field Service - Engage a factory-authorized service representative to inspect field assembled components and equipment installation, including connections, and to assist in field testing.

B. The units shall be listed by Electrical Laboratories (ETL) and bear the ETL label. All wiring shall be in accordance with the National Electrical Code (NEC). The units shall be manufactured in a facility registered to ISO 9001 and ISO14001.

C. The refrigeration piping system shall be provided, installed, tested, evacuated and charged in accordance with the manufacturer's recommendations, ANSI, ASHRAE, and ARI's Safety Code for Mechanical Refrigeration, state and local codes.

D. Perform the following field tests and inspections and prepare test reports:

1. Leak Test - After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test - After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Remove and replace malfunctioning units and retest as specified above.

F. Equipment installer shall attend a controls coordination meeting with the Section 15900 contractor as described in 15900, 1.03.

IV. Submittals

A. Provide shop drawings on this equipment as described in Section 15010, 1.04. The controls coordination meeting described in 15900 shall be held before the shop drawings are submitted.

Part 2 - Products

I. Manufacturers

A. Manufacturers - Provide products by one of the following:

1. Daikin
2. Mitsubishi

3. Samsung
4. Carrier

B. Coordinate any changes from the basis of design with all associated trades. Any additional costs associated with the alternate equipment shall be covered by the equipment manufacturer. No additional costs shall be incurred by the Owner.

II. Refrigerant Components

A. The equipment specified in this section shall operate with refrigerant R410A - no exceptions or substitutions.

B. The system shall utilize fully modulating electronic expansion valves.

C. Refrigerant Piping

1. The refrigerant piping system shall be provided complete and installed in accordance with the manufacturer's recommendations and as specified herein and the requirement of 232300. The size of the refrigerant pipes shall be obtained from the equipment manufacturer unless otherwise shown on the drawings.
2. Pipe, Fittings, and Accessories - The pipe shall be type ACR 'L' copper refrigerant tubing with hard wrought copper fittings. Pipe sized ½ inch and larger shall be hard drawn. Pipe sized 3/8 inch and smaller can either be hard or soft drawn. All of the joints shall be brazed with a filler material that complies with AWS classification BCuP-5. Use type 'L' copper tubing to pipe the relief valve discharge to the outside.
3. Condensate Drain Piping - Shall be type 'L' copper tubing.
4. Pipe Hangers and Supports - Shall be as required in Section 230500.
5. All refrigerant lines shall be insulated from the outdoor unit to the indoor terminal units as shown in Section 230700.
6. The system shall be capable of operating with refrigerant piping up to 492 equivalent feet, a total combined length of 984 feet of piping between the condensing and fan coil units with 164 feet maximum vertical difference, without any oil traps or additional equipment. The vertical difference shall not exceed a maximum of 131 feet where the outdoor unit is located below the indoor unit.

III. Heat Pump Condensing Unit

A. The outdoor unit will have air cooled heat exchange coils constructed from copper tubing with aluminum fins. The coils will be set in a vertical formation with air being drawn in through three sides of the unit and discharged out of the top of the unit. The systems will have a single fan mounted on top of the coils.

B. The outdoor unit will have one inverter controlled hermetic compressor. Partial capacity cooling/heating capability must be available. The system shall use a control sequence to ensure that indoor loads are matched to compressor capacity control.

C. The refrigeration process of the outdoor unit will be maintained by pressure and temperature sensors controlling solenoid valves check valves and bypass valves. The heating or cooling mode of the outdoor unit will be controlled using a combination of two- and three-way valves which will reverse the cycle of the refrigerant to change the mode of the outdoor unit.

D. The variable capacity, heat pump air conditioning system shall be variable refrigerant flow split system. The system shall consist of multiple evaporators using PID control and inverter driven outdoor unit. The unit shall consist of direct expansion (DX), air-cooled heat pump air conditioning system, variable speed driven compressor multi zone split system. The outdoor unit may connect an indoor evaporator capacity of 50-130% to that of the outdoor condensing unit capacity. Each indoor unit shall be capable of operating separately with individual temperature control.

E. The outdoor unit shall be interconnected to indoor unit types specified in this section. The indoor units shall be connected to the outdoor units utilizing the specialized piping joints and headers provided by the equipment manufacturer.

F. General - The outdoor unit is designed specifically for use with manufacturers components:

1. Refrigerant: R410A.
2. The outdoor unit shall be factory assembled and pre-wired with all necessary electronic and refrigerant controls. The refrigeration circuit of the condensing unit shall consist of a compressor, motors, fans, condenser coil, electronic expansion valve, solenoid valves, four-way valve, distribution headers, capillaries, filters, shut off valves, oil separators, service ports, liquid receivers and accumulators.
3. Both liquid and suction lines shall be individually insulated between the outdoor and indoor units.
4. The outdoor unit shall be wired and piped with outdoor unit access from left, right, rear, or bottom.
5. The connection ratio of indoor units to outdoor unit shall be 50% to 130%.
6. The outdoor unit shall have a sound rating no higher than 63 dB(A).
7. The system shall automatically restart operation after a power failure and shall not cause any settings to be lost, thus eliminating the need for re-programming.

8. The outdoor unit shall be modular in design and should allow for side-by-side installation with minimal spacing.
9. The following safety devices shall be included on the condensing unit: high pressure switch, crankcase heaters, high pressure switch, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, and over current protection for the inverter. To ensure the liquid refrigerant does not flash when supplying to the various fan coil units, the circuit shall be provided with a sub-cooling feature. Oil recovery cycle shall be automatic, occurring one hour after system start up, every six hours of system operation or as required to maintain oil levels at the system condensing unit.
10. The outdoor unit shall operate in heating mode to -4F dry bulb ambient temperature without additional ambient controls.

G. Unit Cabinet - The outdoor unit model shall be completely weatherproof and corrosion resistant. The outdoor unit will be constructed from steel plate and treated with acrylic paint, or galvanized steel, bonderized and finished with a powder coated baked enamel.

H. Fan
1. The condensing unit shall consist of a propeller type, direct-drive fan motor that has multiple speed operation via a DC inverter.
2. The fan motors shall have inherent protection and permanently lubricated bearings and be mounted.
3. The fan motors shall be provided with a fan guard to prevent contact with moving parts.

I. Condenser Coil - The condenser coil shall be manufactured from copper tubes expanded into aluminum fins to form a mechanical bond.

J. Compressor
1. The compressor shall be variable speed control capable of changing the speed to follow the variations in total cooling load as determined by the suction gas pressure as measured in the condensing unit.
2. The inverter driven compressor in each condensing unit shall be a high efficiency DC, hermetically sealed compressor.
3. The capacity control range shall be a minimum of 20% to 100% of total capacity.
4. Each compressor shall be equipped with a crankcase heater, high pressure safety switch, and internal thermal overload protector.

5. Oil separators shall be standard with the equipment together with an oil balancing circuit.
6. The compressor shall be mounted to avoid the transmission of vibration.

K. Electrical
1. The power supply to the outdoor unit shall be 208/230 volts, 3 phase, 60 hertz with a voltage range of 187 volts to 253 volts.
2. The control wiring shall be a two-wire multiplex transmission system, making it possible to connect multiple indoor units to one outdoor unit with one 2-cable shielded communications wire.

IV. Heat Recovery Units For Simultaneous Heating And Cooling Systems

A. General - The Heat Recovery Unit shall be designed for use with VRF equipment of the same manufacturer. These units shall be equipped with a circuit board that interfaces to the controls system and shall perform all functions necessary for operation. The unit shall have a galvanized steel finish. The heat recovery unit shall be completely factory assembled, piped, and wired. Each unit shall be run tested at the factory. This unit shall be mounted indoors. The sum of connected capacity of all indoor air handlers shall range from 50% to 150% of rated capacity.

B. Unit Cabinet
1. The casing shall be fabricated of galvanized steel.
2. Each cabinet shall house a liquid-gas separator and multiple refrigeration control valves.
3. The unit shall house tube-in-tube heat exchangers.

C. Refrigerant - R410A refrigerant shall be required for Heat Recovery units in conjunction with outdoor unit systems.

D. Refrigerant Valves
1. The unit shall be furnished with multiple branch circuits which can individually accommodate up to 54,000 BTUH and/or three indoor units. Branches may be twinned to allow more than 54,000 BTUH.
2. Each branch shall have multiple two-position valves to control refrigerant flow for optimum efficiency.
3. Service shut-off valves shall be installed for each branch to allow service to any indoor unit without field interruption to overall system operation. Shut-off valves shall be full-port ball valves, rated at 700 PSIG, with a Schrader port.

4. Linear electronic expansion valves shall be used to control the variable refrigerant flow.

E. Integral Drain Pan - A integral condensate pan and drain, if required, shall be provided.

F. Electrical

1. The unit electrical power shall be 208/230 volts, 1 phase, 60 hertz.
2. The unit shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253V (230V/60Hz).
3. The Heat Recovery unit shall be controlled by integral microprocessors.
4. The control circuit between the indoor units and the outdoor unit shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

V. Indoor Air Handling Units

A. It shall be possible for the total connected capacity of the indoor units to be between 50 and 130% of the capacity of the outdoor unit.

B. Each indoor unit will have a heat exchanger which shall be constructed from copper tubing with aluminum fins. The flow of refrigerant through the heat exchanger will be controlled by an electronic proportional expansion valve. This valve will be controlled by two pipe thermistors, a return air and discharge air thermistor and shall be capable of controlling the variable capacity of the indoor unit between 25% and 100%.

C. Each indoor unit shall have an operating voltage of 208-230V/1 phase/60Hz. The indoor unit shall supply demand capacity information to the outdoor unit via its control algorithm.

D. Indoor units shall not be the primary source of dehumidification in a large capacity designed space (classrooms, etc.), nor should indoor units be the primary source of ventilation. A DOAS or outside air processing unit shall be installed in conjunction with a variable refrigerant flow system.

E. Unconditioned outside air shall not be directly introduced to indoor units. Indoor units providing ventilation shall be supplied from a DOAS or outside air processing unit.

F. Four (4) Way Ceiling Cassette Indoor Unit

1. The indoor unit shall be a ceiling cassette fan coil unit for installation into the ceiling cavity equipped with an air panel grille to be connected to indoor unit as scheduled and specified in this section. The indoor unit shall have a four-way air distribution type, impact resistant and washable decoration panel. The supply air shall be

distributed via motorized louvers which can be horizontally and vertically adjusted from 0 degree to 90 degree angle.

2. Construction
   a) The indoor unit shall be completely factory assembled and tested. The unit shall include factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, condensate drain pan, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
   b) The 4-way supply airflow shall be field modifiable to 3-way and 2-way airflow to accommodate various installation configurations including corner installations.
   c) Return air shall be through the concentric panel, which shall include a filter.
   d) The indoor unit shall be equipped with a condensate pan.
   e) The indoor unit shall be equipped with a return air thermistor.
   f) The indoor unit shall be separately powered with 208-230V/1 phase/60Hz.
   g) The voltage range shall be 253 volts maximum and 187 volts minimum.
   h) The indoor unit shall be equipped with a condensate pump capable of providing at least 19" of lift.
3. Unit Cabinet
   a) The cabinet shall be space saving and shall be located into the ceiling.
   b) The airflow of the unit shall have the ability to shut down one or two sides allowing for simpler corner installation.
   c) Provide fresh air intake kit where used and indicated on the drawings. A branch duct knockout shall exist for branch ducting supply air.
4. 4. Fan
   a) The fan shall be direct-drive turbo fan type with statically and
   b) dynamically balanced impeller with high and low fan speeds available.
   c) The indoor unit shall operate with a power supply of 208/230 volts, 1 phase, 60 hertz. The allowable voltage range shall be 187 to 253 volts.
   d) The airflow rate shall be adjustable and have high, medium and low fan settings.
   e) The fan motor shall be thermally protected.
5. Filter - The return air shall be filtered by means of a long-life filter.
6. Coil

a) Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
b) A condensate pan shall be located under the coil. The condensate pan shall have a built in high level safety alarm to shut down the unit.
c) A thermistor shall be located on the liquid and gas line.

G. One (1) Way Ceiling Cassette Indoor Unit
1. The indoor unit shall be a ceiling cassette fan coil unit for installation into the ceiling cavity equipped with an air panel grille to be connected to indoor unit as scheduled and specified in this section. The indoor unit shall have a one-way air distribution type, impact resistant and washable decoration panel. The supply air shall be distributed via motorized louvers which can be horizontally and vertically adjusted from 0 degree to 90 degree angle.
2. Construction
a) The indoor unit shall be completely factory assembled and tested. The unit shall include factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, condensate drain pan, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
b) Return air shall be through the concentric panel, which shall include a filter.
c) The indoor units shall be equipped with a condensate pan.
d) The indoor units shall be equipped with a return air thermistor.
e) The indoor unit shall be separately powered with 208-230V/1 phase/60Hz.
f) The voltage range shall be 253 volts maximum and 187 volts minimum.
g) The indoor unit shall be equipped with a condensate pump capable of providing at least 23" of lift.
3. Unit Cabinet
a) The cabinet shall be space saving and shall be located into the ceiling.
b) Provide fresh air intake kit where used and indicated on the drawings. A branch duct knockout shall exist for branch ducting supply air.
4. 4. Fan
a) The fan shall be direct-drive fan type with statically and dynamically balanced impeller with high and low fan speeds available.
b) The indoor unit shall operate with a power supply of 208/230 volts, 1 phase, 60 hertz. The allowable voltage range shall be 187 to 253 volts.

c) The airflow rate shall be adjustable and have high, medium and low fan settings.

d) The fan motor shall be thermally protected.

5. Filter - The return air shall be filtered by means of a long-life filter.

6. Coil

a) Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.

b) A condensate pan shall be located under the coil. The coil in the condensate pan shall have a built in high level safety alarm to shut down the unit.

c) A thermistor shall be located on the liquid and gas line.

VI. Controls

A. The units shall have controls provided with the unit by the manufacturer to perform input functions necessary to operate the system.

B. Computerized PID control shall be used to maintain room temperature within 1F of setpoint.

VII. Controllers

A. Physical Characteristics - The control system shall be a neutral color plastic material with a Liquid Crystal Display (LCD).

B. Electrical Characteristics

1. General - From each circuit board to the controls, the electrical voltage shall be 16 - 24 volts DC.

2. Wiring: Control wiring shall be installed in a daisy chain configuration from indoor unit to indoor unit then to the outdoor unit. Control wiring shall run from the indoor unit terminal block to the specific controller for that unit.

3. Wiring Size: The wire shall be a shielded, size AWG16-2 or AWG 18-2.

C. Individual Zone Controller

1. The simplified wired remote controller shall be able to control 1 group (maximum of 16 fan coil units).

2. The simplified wired remote controller shall have the following features:

a) Operation - Start/Stop, Operation Mode, Temperature Setting, 60F - 90F Set Point Range, Fan Speed, Airflow Direction.

b) Monitoring - Status, malfunction flashing, malfunction content, filter sign, operation mode, temperature setting, permit/prohibit selection, fan speed, airflow direction.

c) Scheduling - ON/OFF Timer.

d) Control Management - Field Setting Mode, Group Setting, Auto Restart.

D. Centralized Controller

1. The Centralized Controller shall be capable of controlling a maximum of 50 indoor units across multiple outdoor units. Centralized controller shall have a color LCD touch-screen. The Centralized Controller shall support system configuration, daily/weekly scheduling, monitoring of operation status, night setback settings, free contact interlock configuration and malfunction monitoring. The Centralized Controller shall have five basic operation controls which can be applied to an individual indoor unit, a group of indoor units (up to 50 indoor units), or all indoor units (collective batch operation). This basic set of operation controls for the Centralized controller shall include on/off, operation mode selection (cool, heat, auto, dry, and fan), temperature setting, fan speed setting, and airflow direction setting. The Centralized Controller shall allow the user to define both daily and weekly schedules with operations consisting of ON/OFF, mode selection, temperature setting, air flow (vane) direction, fan speed, and permit/prohibit of remote controllers.

E. BACnet Interface to Building Automation System

1. The cooling and heating BACnet7 interface shall be compliant with BACnet7 Protocol (ANSI/ASHRAE 135-2004) and be Certified by the (BTL) BACnet7 Testing Laboratories. The BACnet7 interface shall support BACnet Broadcast Management (BBMD). The BACnet7 interface shall support a maximum of 50 indoor units. Operation and monitoring points include, but are not limited to, space temperature, space temperature setpoint, on/off, operation mode, fan speed, prohibit remote controller, filter sign reset, alarm state, error code and error address.

F. Control Panel

1. This contractor shall deliver the components of the centralized controllers and the BACnet interface devices to the Division 15900 contractor. It is the responsibility of the Division 15900 contractor to construct the control panel, housing these components in compliance with 15900 specification 2.02F.

G. Indoor Unit Sequence of Operations

1. On/Off Control - the indoor units shall be commanded ON/OFF by the BAS. If all indoor units are off, the outdoor unit shall turn off. With the Night Setback

Function/Mode, the system shall cycle on during unoccupied periods as needed to maintain unoccupied temperature setpoint of 55°F (adjustable).

2. Space Temperature Control - the indoor unit shall modulate its internal linear expansion valve (LEV) to maintain the temperature setpoint via the indoor unit's internal controls.
   a) The setpoint is provided and adjustable through the BAS interface.
   b) The temperature setpoint provided through the BAS interface shall additionally be adjustable to a maximum of ±2°F from that setpoint using the room controller.
3. Mode Control
   a) Auto Mode
      (1) The indoor unit shall determine whether it should be in auto-heat mode or auto-cool mode based on space temperature relative to temperature setpoint. If the indoor unit is in auto-heat mode, the indoor unit control board shall follow the heat mode sequence. If the indoor unit is in auto-cool mode, the indoor unit control board shall follow the cool mode sequence.
      (2) The indoor unit shall switch from auto-heat to auto-cool when the space temperature rises above and remains above the temperature setpoint plus the dead band for 3 minutes.
      (3) The indoor unit will switch from auto-cool to auto-heat when the space temperature drops below and remains below the temperature setpoint minus the dead band for 3 minutes.
   b) Heating Mode - the indoor unit shall modulate its linear expansion valve (LEV) to maintain temperature setpoint of 71°F (adjustable).
   c) Cooling Mode - the indoor unit shall modulate its linear expansion valve (LEV) to maintain temperature setpoint of 74°F (adjustable).

Part 3 - Execution

I. Installation

A. Install all piping, fittings, and insulation to meet manufacturers requirements. Install units level and plumb. Condenser fan components shall be installed using manufacturer's standard mounting devices securely fastened to building structure (Thybar TEMS or approved equal). Install and connect refrigerant tubing and fittings.

Pipe penetrations through the roof shall be installed with a pipe curb assembly (Thybar TCC or approved equal).

B. Installer shall supply isolation ball valves for zoned refrigerant isolation. Installer shall supply Isolation ball valves with Schrader connection for isolating refrigerant charge and evacuation at each connected air handling unit and condensing unit. Isolation ball valves, with Schrader connection, are required for instances of air handling unit isolation for troubleshooting, repair, or replacement without affecting the remainder of the system. Isolation ball valves with Schrader connection are also required at condensing unit connection to isolate unit for troubleshooting, repair or replacement and as required to provide partial capacity Heating/Cooling in the instance of a failure of one of the multiple outdoor unit (condensing unit) compressors.

C. During brazing an inert gas (such as nitrogen) shall be continuously passed through the system at a rate sufficient to maintain an oxygen free environment to prevent the formation of copper oxide scale. After piping has been completed, the refrigerant piping system shall be pressure tested at a pressure of 300 psi on the high side and 150 psi on the low side. The pressure shall be maintained on the system for a minimum of 24 hours. The system shall be evacuated when the surrounding ambient air is not less than 60 F. If the temperature is less, auxiliary heat must be provided to insure proper evacuating conditions. A minimum vacuum of 300 Microns of Hg. shall be pulled on the system and maintained for 24 hours. The vacuum pump displacement shall be not less than 2 cfm for up to 15 tons. The system shall be charged as recommended by the equipment manufacturer.

D. Electrical wiring required by this section, both high and low voltage, shall comply with the Division 16 requirements.

E. Start Up - Engage manufacturer or factory-authorized service representative to perform startup service. Manufacturer shall provide on-site startup and commissioning assistance through job completion. Complete installation and startup checks according to manufacturers written instructions. This shall include a factory startup for factory provided control devices as well as configuring control points for other DO devices. Service representative shall completely configure all control devices and establish remote internet connectivity with the owner’s energy management department web server.

F. Demonstration - Engage manufacturer or factory-authorized service representative to demonstrate and instruct the owner's maintenance personnel of the operation and functionality of the system.

G. Training - Engage manufacturer or factory authorized service representative to train owner's maintenance personnel for a period of 2 days, to adjust, operate and maintain individual units and complete system. This shall also include training of the owner's energy management department representatives as to establish control system programming, scheduling routines, alarm reporting, system topography, communication protocols and password level assignments. This training shall take place on-site and at the owner's maintenance facility.

H. The indoor air handling and outside condensing units shall be installed in accordance with the manufacturer's recommendations and as shown on the drawings. The first unit installed will be considered the typical mock up and shall require notification, inspection and approval by the designated owner representative and/or architect and engineer before any additional installations will be allowed.

I. Provide laminated as built drawings and manufacturer's refrigeration piping layout showing typical layout of the system. This shall include the actual room numbers, not from construction documents, and addressing scheme. Laminate shall have minimum thickness of 10 mil. Drawing size shall be 11"x17". Provide multiple drawings should zones not fit into one page.

J. Refrigerant distribution (BC) controllers shall include a label affixed to the controllers which identifies the room or rooms served for each line set on the controller. Use the actual room numbers and not from construction documents.

K. Provide a typed list of all the different units, their filter sizes, and belt sizes to be included in the O&M manuals. The list shall include the unit designation, filter size, belt size, and the number of filters and belts required for each unit. In addition to this, submit to the Owner two additional copies of the list, distributed to the PGCPS project manager of record and PGCPS Building Services.

L. Warranty Tag - The Contractor shall attach an engraved weatherproof Guarantee or Warranty tag to the exterior of each condensing unit. Tag is to be screwed or riveted to unit. Identification tag shall be black with engraved 3" white letters which reads:

UNIT # *(unit number)*

INSTALLED BY:	*(contracting company's name)*
WARRANTY EXPIRES:	*(month/day/year)*
COMPRESSOR WARRANTY EXPIRES:	*(month/day/year)*

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 - General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope
   A. Provide and install electric duct heater as shown on the drawings and as specified herein.

III. Quality Assurance
   A. The electric duct heater shall have published ratings and be listed by Underwriters Laboratories.
   B. Equipment installer shall attend a controls coordination meeting with the Section 230923 contractor as described in 230923, 1.03.

IV. Submittals
   A. Provide shop drawings on this equipment as described in Section 230100, 1.04. The controls coordination meeting described in 230923 shall be held before the shop drawings are submitted.

Part 2 - Products

I. Electric Duct Heater
   A. The electric duct heater shall be of the type, capacity and voltage shown on the drawings. Acceptable manufacturers include:
      1. Indeeco
      2. Carnes
      3. Environmental Technologies
   B. Type – Shall be of the open type using wire constructed of 80% nickel and 20% chromium supported in ceramic bushings. The heating wire for each step shall be strung across the entire face of the coil to prevent stratification when operating at less than full capacity. Maximum watts density shall not exceed 35 watts per 1 sq. in. of wire surface.
   C. Trim – All terminals and nuts shall be constructed of stainless steel, and terminal insulators and bracket bushings shall be constructed of ceramic and securely positioned.
   D. Test – Heating coils shall be tested for twice the rated voltage plus 1000 volts, or 2000 volts whichever is greater. After the heater is built, the manufacturer’s quality control

inspection shall test the heater for the following: Ohm reading to verify capacity, voltage, phase, control voltage and tightness of terminals.

E. Casing – shall be constructed of not less than 16 or 18 gauge galvanized steel with vertical galvanized steel supports 4” on center gusseted and spot welded. A solid cover shall be provided on the terminal box to minimize dust in the terminal box. The terminal box shall be recessed when installed in air handling units. Mounting provisions shall be flanged or slip-type as shown in the equipment schedule.

F. Safety Features – Shall include an automatic reset thermal cutout wired in series with the control circuit and heat timers (fusible links) wired in series with the power legs. All of the safety devices shall be serviceable through the terminal box without removing the heater from the duct.

G. Built-in Features – Shall include contactors, transformers, interlock relay, fusing to meet NEC requirements and lugs sized to receive specified conductors. All built-in components shall be factory wired and mounted on the heating coil in an integral terminal box. The unit shall be complete with terminal strip for electrical connections.

H. The duct heater shall be controlled as shown on the drawings or in the Automatic Temperature Control Section.

Part 3 - Execution

I. Installation

A. The electric duct heater shall be installed in accordance with the manufacturer's recommendations and as shown on the drawings.

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 -General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope
   A. Provide and install complete the fan coil units as shown on the drawings and specified herein.

III. Quality Assurance
   A. The fan coil units shall be Underwriters Laboratories listed and be rated in accordance with ARI Standards 440-81.
   B. Equipment installer shall attend a controls coordination meeting with the Section 230923 contractor as described in 230923, 1.03.

IV. Submittals
   A. Provide shop drawings on this equipment as described in Section 230100, 1.04. The controls coordination meeting described in 230923, 1.03 shall be held before the shop drawings are submitted.

Part 2 - Products

I. Fan Coil Units
   A. Provide and install fan coil units of the type and capacity as shown on the drawings and specified herein. Acceptable manufacturers include:
      1. Trane
      2. Carrier
      3. Daikin.
   B. Assembly Description - The unit shall consist of a finished room cabinet with configuration as shown, access openings, discharge and intake grilles, toe space base, connection pockets, noted coils, drain pan, fan and motor assembly, filter and control box. Non-metallic blower wheels will not be accpeted.
   C. Cabinet
      1. The cabinet shall be constructed of galvanized steel panels, acoustically and thermally insulated with glass fiber blanket material. The cabinet shall be constructed of a minimum of 18-gauge steel on top and sides with 16 gauge front panels. The

interior chassis shall be constructed of not less than 16 gauge galvanized steel and shall be coated with rust inhibiting paint. Cabinet shall have baked enamel finish with color selected from manufacturer's selection chart by the Architect.

2. The discharge grille shall be integral stamped metal unless noted otherwise. Discharge shall be slanted top unless otherwise approved in writing by PGCPS.

D. Coils - Shall be constructed of aluminum fins mechanically bonded to seamless copper tubes, with continuous fin collars and sleeved coil and supports. Coils shall be factory tested at 300 psi. Coil connections shall be at opposite ends. Hot water coils shall be placed in a pre-heat position in all units.

E. Drain pan shall be an IAQ type non-corrosive, positively sloped, insulated and cleanable drain pan. It shall fit under the coil and control valves and be sized to collect the water from all component chilled surfaces. Pan insulation shall be selected to prevent condensation on pan surfaces.

F. Motor and Fan - Shall be direct driven, forward curved, centrifugal, double width type, quiet operating design. The motor shall be multi-speed, permanent split capacitor, continuous duty, high efficiency type. Motor shall have built-in thermal overload protection. The electric inputs shall not exceed those listed on drawings.

G. Filters shall be concealed and accessible without removing front panel. They shall be the throwaway type and 1” thick.

H. Controls - The fan shall be controlled with a multi-speed fan switch with auxiliary taps located in an accessible lockable end compartment. The temperature controls shall be as shown in Section 230923 - Automatic Temperature Controls.

I. All floor mounted fan coil units shall be provided with a sub-base.

J. All horizontal, semi-recessed fan coil units shall be provided with a telescoping ceiling panel with hinged access and intake grille.

Part 3 - Execution

I. Installation

A. The fan coil units shall be installed in accordance with the manufacturer's recommendations and as shown on the drawings. Install sub-bases on all floor-mounted units. The first unit installed will be considered the typical mock up and shall require notification, inspection and approval by the designated owner representative and/or architect and engineer before any additional installations will be allowed.

B. Piping - Shall be as described in Section 232113, 232300 and/or 232213. Provide supply and return ball valves, manual air vents and drain plugs.

C. Filters - Shall be changed at the end of the construction period and before the final inspection.

D. Provide a minimum 18” long section of removable horizontal pipe enclosure, for floor mounted units that can not be piped from opposite ends, to locate valves in. Provide end caps.

E. Two sets of spare filters shall be provided in addition to the set used during construction with each unit. The filters shall be changed after the construction dust has been eliminated and before the final inspection. The other set of filters shall be stored in the respective mechanical rooms or spaces.

F. Provide a typed list of all the different fan coil units and their filter sizes to be included in the O&M manuals. In addition to this, submit to the Owner two additional copies of the list, distributed to the PGCPS project manager of record and PGCPS Building Services.

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 - General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods shall apply to this section.

II. Scope
   A. Provide and install, complete, the unit ventilator as shown on the drawings and specified herein.

III. Quality Assurance
   A. The unit ventilator shall be Underwriters Laboratories listed or be tested by an accepted independent testing agency.
   B. Equipment installer shall attend a controls coordination meeting with the Section 230923 contractor as described in 230923, 1.03.

IV. Submittals
   A. Provide shop drawings on this equipment as described in Section 230100 - 1.04. The controls coordination meeting described in 230923, 1.03 shall be held before the shop drawings are submitted.

Part 2 - Products

I. Unit Ventilators
   A. Provide and install unit ventilator(s) of the type and capacity as shown on the drawings and specified herein. Acceptable manufacturers include:
      1. Trane
      2. MagicAire
      3. McQuay
      4. Carrier.
   B. Assembly Description - The unit shall consist of a finished room cabinet with configuration as shown, access openings, discharge and intake grilles, toe space base, connection pockets, noted coils, drain pan, fan and motor assembly, damper assembly, outside air inlet, filter and control box and factory supplied extension cabinet for housing shutoff and control valves. Units with plastic blower wheels are not acceptable.
   C. Cabinet

1. The cabinet shall be constructed of 14 gauge steel panels, acoustically and thermally insulated with glass fiber blanket material. All exposed edges shall be rounded. The interior chassis shall be constructed of not less than 16 gauge galvanized steel and shall be coated with rust inhibiting paint. Cabinet shall have baked enamel finish with color selected from manufacturer's selection chart by the Architect.
2. Front panels shall be removable in sections. They shall be secured by allen wrench operated quick open fasteners. The cabinet shall have a separate space for piping and wiring crossover. Provide access opening for adjustment and service access.
3. Return air intake grille shall be bottom front face located or recessed in toe space slotted kick plate type.
4. Discharge air grille shall be top mounted, continuous; round edged steel bars with 10 degrees vertical deflection.

D. The coils shall be constructed of aluminum fins mechanically bonded to seamless copper tubes, with continuous fin collars and sleeved coil and supports. Coils shall be factory tested at 300 psi. Coils connections shall be at opposite ends. Hot water coils shall be placed in a pre-heat position in all units. Chilled water coil connections shall be on the opposite end from the electrical connections. 2-pipe systems shall have coil connections on the opposite end from the electrical connections.

E. The drain pan shall be an IAQ type non-corrosive positively sloped and cleanable drain pan. It shall fit under the coil and control valves and be sized to collect the water from all future component chilled surfaces. Pan insulation shall be selected to prevent condensation on pan surfaces.

F. Motor and Fan - Shall be direct driven, forward curved, centrifugal, double width type, quiet operating design. The motor shall be multi-speed, permanent split capacitor, continuous duty, high efficiency type. Motor shall have built-in thermal overload protection. The electric inputs shall not exceed those listed on drawings. Thermoplastic materials on steam type units are not acceptable.

G. The filters shall be concealed and accessible without removing front panel. They shall be the throwaway type and 1” thick.

H. Controls - The fan shall be controlled with a multi-speed fan switch with auxiliary taps located in an accessible lockable end compartment. The temperature controls shall be as shown in Section 230923 - Automatic Temperature Controls.

I. Provide factory installed float control safety switch in condensate drain pans. Float shall stop unit upon activation.

Part 3 - Execution

I. Installation

A. The unit ventilator shall be installed in accordance with the manufacturer's recommendations and as shown on the drawings.

B. Piping - Shall be as described in Section 232113, 232213 or 232300. Provide supply and return gate valves, manual air vents and drain plugs.

C. Filters - Shall be changed at the end of the construction period and before the final inspection.

D. Provide spare fuses for unit ventilators for each size of fuse used in accordance with the following schedule:

Number of Ventilators	Spares Required
1-10	2
11-20	4
21-30	6
31-40	8
Over 40	10

E. Provide a typed list of all the different unit ventilators and their filter sizes to be included in the O&M manuals. In addition to this, submit to the Owner two additional copies of the list, distributed to PGCPS project manager of record.

F. The unit ventilators shall be installed in accordance with the manufacturer's recommendations and as shown on the drawings. The first unit installed will be considered the typical mock-up and shall require notification, inspection and approval by the designated owner representative and/or architect and engineer before any additional installations will be allowed.

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 -General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope
   A. Provide and install convectors as shown on the drawings and specified herein.

III. Quality Assurance
   A. Convectors shall have published AHRI ratings.

IV. Submittals
   A. Provide shop drawings on this equipment as described in Section 15010 - 1.04.

Part 2 - Products

I. Hot Water Convectors
   A. The hot water convectors shall be of type and capacity shown on the drawings. Acceptable manufacturers include:
      1. Sterling
      2. Vulcan
      3. Trane
      4. Zehnder-Rittling.
   B. Enclosure - Cabinet front and top panels shall be 14-gauge steel. End panels shall be reinforced 18 gauge. Front panel shall have horizontal stiffening channel. Cabinet backs shall be phosphatized, galvanized; front, top and sides shall be phosphatized and painted inside and out with one coat of gray primer. Provide baked enamel finish with color selection by architect. Fronts shall be secured in place by quick opening slide bolts or camlock fasteners. Convector styling shall match fin-tube enclosure styling. All cabinets shall have recessed framed air outlets. Provide damper blade with a vandal resistant, allen head external operator.
   C. Heating Element - Shall be constructed of aluminum fins, ribbed steel side plates, fin tube supports and copper tubes expanded and rolled into cast iron headers. Fins shall have integral fin collars, which space the fins and provide fin-to-tube surface firmly bonded to the tube by mechanical expansion of the tube. All elements shall withstand 150-lb. air pressure factory tested under water.

II. Steam Convectors

A. The hot water convectors shall be of type and capacity shown on the drawings. Acceptable manufacturers include:

1. Sterling
2. Vulcan
3. Trane
4. Zehnder-Rittling.

B. Enclosure - Cabinet front and top panels shall be 14-gauge steel. End panels shall be reinforced 18 gauge. Front panel shall have horizontal stiffening channel. Cabinet backs shall be phosphatized, galvanized; front, top and sides shall be phosphatized and painted inside and out with one coat of gray primer. Provide baked enamel finish with color selection by architect. Fronts shall be secured in place by quick opening slide bolts or camlock fasteners. Convector styling shall match fin-tube enclosure styling. All cabinets shall have recessed framed air outlets. Provide damper blade with a vandal resistant, allen head external operator.

C. Heating Element - Shall be constructed of extended surface 0.010 inch thick aluminum fins mechanically bonded to 5/8 inch O.D. seamless copper tubing. Braze tubes to Schedule 40 steel headers, and factory test at 500 psig hydrostatic pressure and 200 psig steam pressure. Submit test results to the Owner.

Part 3 - Execution

I. Installation

A. Convectors shall be installed as shown on the drawings and in accordance with the manufacturer's recommendations.

B. Furnish integral thermostat on the unit or wall-mounted thermostat as scheduled.

END OF SECTION

Part 1 - General

I. General
   A. The Bidding and Contract Requirements, Division 1 -General Requirements, Section 230100 - General Provisions, and Section 230500 - Basic Materials and Methods, shall apply to this section.

II. Scope
   A. Provide and install complete with all accessories the hot water finned tube radiation and steam radiation as shown on the drawings and as specified herein.

III. Quality Assurance
   A. The hot water finned tube radiation shall have published ratings and be certified by IBR.
   B. Equipment installer shall attend a controls coordination meeting with the Section 15900 contractor as described in 230923, 1.03.

IV. Submittals
   A. Provide shop drawings on this equipment as described in Section 23010, 1.04. The controls coordination meeting described in 230923 shall be held before the shop drawings are submitted.

Part 2 - Products

I. Hot Water Finned Tube Radiation
   A. The hot water finned tube radiator shall be of the type and capacity shown on the drawings. Acceptable manufacturers include:
      1. Sterling.
      2. Vulcan
      3. Zehnder-Rittling.
   B. Enclosure - shall be constructed of 14 gauge steel and shall mount into a continuous roll-formed captive channel mounting strip which permits hinge type mounting and access at the top and invisible fastening onto a rigid, 14 gauge steel enclosure brackets at the bottom. Enclosure brackets shall be spaced at not more than 4-foot intervals. Front panels shall be individually removable to facilitate cleaning, servicing or replacement. All accessories shall fasten to the enclosure assembly in a manner, which prevents contact with the back wall during installation. Cabinet air outlets of sheet metal

shall be recessed and framed. Enclosure shall have baked enamel finish with color selection by Architect.

C. Heating Element - Copper tube aluminum fin element types, as indicated on plans, shall have integral fin collars which space the fins and provide fin-to-tube surface firmly bonded by mechanical expansion of the tube. Elements shall be positively positioned front-to-back, with provisions for silent horizontal expansion and contraction.

II. Steam Finned Tube Radiation

A. The steam finned tube radiator shall be of the type and capacity shown on the drawings. Acceptable manufacturers include:

1. Sterling.
2. Vulcan
3. Zehnder-Rittling.

B. Enclosure - shall be constructed of 14 gauge steel and shall mount into a continuous roll-formed captive channel mounting strip which permits hinge type mounting and access at the top and invisible fastening onto a rigid, 14 gauge steel enclosure brackets at the bottom. Enclosure brackets shall be spaced at not more than 4-foot intervals. Front panels shall be individually removable to facilitate cleaning, servicing or replacement. All accessories shall fasten to the enclosure assembly in a manner, which prevents contact with the back wall during installation. Cabinet air outlets of sheet metal shall be recessed and framed. Enclosure shall have baked enamel finish with color selection by Architect.

C. Heating Element - Single-width flat horizontal steam tubes with header in rear. Tubes shall be 2 3/4 inches high and 1/4 inch deep. Headers shall have all necessary inlet, outlet, venting and draining connections, and baffles to ensure even heating output. All units shall have 3/4 inch NPT connections. All radiator components shall be carbon steel. Element shall have corrugated steel fins welded to tube with finish to match tubes. Elements shall be single or multi-tiered as scheduled. Mounting brackets shall be No. 12 gauge steel. End caps shall be provided with tight-fitting access doors to all valves without visible hinges.

Part 3 - Execution

I. Installation

A. The finned tube radiation shall be installed complete with all accessories in accordance with the manufacturer's recommendations and as shown on the drawings.

B. Set radiators as indicated on the Drawings with tops level, and fronts and ends plumb. Radiators shall be rigidly attached to adjoining building construction.
C. Joints between radiators and adjoining building material surfaces shall be tight and neatly fitted.
D. Conceal all fasteners.
E. Locate isolation valves above floor slab, and provide access doors at valve locations.

END OF SECTION

Part 1 - General

I. Summary (Non-inclusive)

A. It is the intent of this Specification that this Contractor furnish and install all material, labor, equipment, apparatus, tools, transportation, and other incidentals required to provide the following: electrical service(s); power distribution (both normal and stand-by emergency power); branch circuit wiring; low voltage wiring; wiring devices; grounding; lighting (both interior and exterior); lighting control systems; fire detection and alarm system; security intrusion system; door video access entry system; wireless master clock and program system; sound and intercommunications system and program system; classroom amplification systems; auxiliary sound reinforcement systems; auditorium sound reinforcement system; Black Box Theater sound reinforcement system; gymnasium sound reinforcement systems; band, choral, and orchestra sound reinforcement systems; athletic fields sound reinforcement systems; dance and gymnastics sound reinforcement systems; telecommunications system; cable television/broadband distribution system; and multi-media systems as shown on Drawings and as described in these Specifications.

II. Requirements

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

B. Provisions of this Section apply to each and every Section of this Division.
Applicable Sections: Division 1.

III. Scope

A. It is the intention of these Specifications and the Contract Drawings to call for finished work, tested and ready for operation.

B. Any apparatus, appliances, materials, or work not indicated but mentioned in these Specifications, or vice versa, or any incidental accessories necessary to make the work complete and perfect in all respects and ready for operation, even if not particularly specified, shall be furnished, delivered, and installed by this Contractor at no additional expense to the Owner.

C. Minor details not usually shown or specified, but necessary for the proper installation and operation shall be included the same as if herein specified or shown on the Drawings.

D. With submission of bid, this Contractor shall give written notice to the Architect/Engineer of any materials or apparatus believed: inadequate or unsuitable; in violation of federal, state, and local laws, codes, and ordinances, including Prince George's County's electrical inspection rules or regulations; and any necessary items of the work which have been omitted. In the absence of such written notice, it shall be mutually agreed that the Contractor has included the cost of all required items in the proposal and that the Contractor shall be responsible for the approved satisfactory functioning of the entire electrical system and low voltage electrical systems at no additional expense to the Owner.

IV. Applicable Specifications, Codes, Standards, And Permits

A. Materials, equipment, and installation shall be in accordance with the requirements of the latest adopted editions of the National Electrical Code (NEC), and these Specifications.

B. Unless otherwise specified herein the work and material shall conform to the applicable requirements of the (latest editions or currently adopted) following codes, standards, and regulations:

1. American National Standards Institute (ANSI).
2. Americans with Disabilities Act Code of Federal Regulation (ADA).
3. Canadian Standards Association (CSA).
4. Electronic Industries Association/Telecommunications Industry Association (EIA/TIA)
5. Prince George's County Fire Marshal's Office.
6. Illuminating Engineering Society (IES).
7. International Building Code (IBC)
8. International Code Council (ICC)
9. National Electrical Code (NEC).
10. National Electrical Contractors Association (NECA).
11. National Electrical Manufacturer's Association (NEMA).
12. National Fire Protection Association (NFPA).
13. Occupational Safety and Health Association (OSHA).
14. Underwriters Laboratories, Inc. (UL).

C. All electrical materials and equipment shall be new, listed by UL, and bear the UL label. This applies to all equipment for which UL standards have been established and label service is regularly furnished.

D. Equipment not UL labeled and equipment assembled in the field using UL components and not UL labeled as an "assembly", for which standards have not been promulgated, shall be accepted upon certification by MET ELECTRICAL TESTING, LLC, 4390 Parliament Place, Suite Q, Lanham, MD 20706 telephone: 240-487-1900 or ELECTRICAL TESTING CORPORATION, 1701 Edmondson Avenue, #201, Baltimore, Maryland, 21228, telephone 410-526-4700. Cost of such certification shall be included in the base bid and in each quoted cost for alternates and proposed change orders. Electrical equipment that requires certification shall be tested by this Contractor at no additional cost to the Owner.

E. Workmanship shall conform to the "Standard of Installation" published by the NECA. This Contractor shall provide a minimum of one (1) licensed journeyman electrician for each three (3) electrical workers assigned to this project. Such certification shall be provided to the Architect/Engineer upon request.

F. This Contractor shall: give all necessary notices; obtain all permits (including a low voltage wiring permit); pay all government taxes, fees, and other costs including, but not limited to the Prince George's County Fire Marshal's Office shop drawing review fees; file all necessary plans; prepare all documents; and obtain required certificates of inspection for work and deliver same to the Architect/Engineer before any request for acceptance and final payment for the work.

G. This Contractor shall be responsible for purchasing equipment and appliances that bear the label of an agency as approved by the Prince George's Department of the Environment (DoE). It shall be the responsibility of the Contractor to pay for any label testing of equipment or appliances that are installed without the label of a DPWES approved agency.

V. Reviews And Shop Drawings

A. The materials, workmanship, design, and arrangement of all work installed under this contract shall be subject to the review of the Architect/Engineer and Owner.

B. Where any specified materials, process, or method of construction or manufactured article is specified by name, or by reference to the catalog number of a manufacturer, the specifications are to be used as a guide and are not intended to take precedence over the basic duty and performance specified or noted on the Drawings.

C. In all cases, the Contractor shall verify the duty and available electric characteristics with the specific characteristics of the equipment offered for review.

D. All component parts of each item of equipment or device shall bear the manufacturer's name plate giving name of manufacturer, description, size, type, serial or model number, electrical characteristics, etc., in order to facilitate maintenance or replacement. The nameplate of a Contractor will not be acceptable.

E. If materials or equipment are installed before they have been reviewed by the Architect/Engineer, the Contractor shall be liable for their removal and replacement at no additional expense to the Owner, if in the opinion of the Architect/ Engineer, material or equipment does not meet the intent of the Drawings and Specifications.

F. This Contractor shall call to the attention of the Architect/Engineer by letter or on shop drawing submittals, any instance in which the shop drawings differ from the requirements of the Drawings and Specifications.

G. Data and shop drawings shall be coordinated and included in a single submission in a bound format. Multiple submissions are not acceptable except where prior approval has been obtained from the Architect/Engineer. In such cases, a list of data to be submitted later shall be included with the first submission. No delays in construction occasioned by the Contractor's failure to submit material in accordance with the approval schedule will be excused.

H. Catalogs, pamphlets, or other documents submitted to describe items on which review is being requested shall be specific and identifications in catalog, pamphlets, etc., of items submitted shall be clearly made in a contrasting ink. Data of a general nature shall not be acceptable.

I. Submitted samples, drawings, specifications, catalogs, and the like shall be properly labeled and shall indicate: specified service for which the material or equipment is to be used; Section and Article number of Specifications governing; contractor's name; and name of the job.

J. If applicable, contractor shall submit to PGCPS any required applications for utility rebates and/or incentives for each eligible piece of equipment in project. Contractor is responsible for furnishing all engineering submittals, drawings, calculations, load modeling as required for rebate and incentive programs. Contractor shall work in conjunction with PGCPS Management Analyst under the Department of Building Services during the design phase of the project to complete and submit necessary forms. This shall be coordinated prior to purchase of any eligible equipment provided under Division 26.

K. Data and shop drawings shall be identified in accordance with SECTION 01340. In addition, shop drawings shall be identified by the name of the item and system and the applicable Specification paragraph number. This Contractor shall submit the following components/systems described herein and as specified in other Sections of this Specification.

1. Athletic fields sound reinforcement systems.
2. Auditorium lighting controls and performance lighting.
3. Auditorium sound reinforcement system.
4. Auxiliary sound reinforcement systems.
5. Band, Orchestra, and Choral rooms sound reinforcement systems.
6. Black Box Theater performance lighting controls and lighting.
7. Black Box Theater sound reinforcement system.
8. Boxes including device, junction, outlet, and pull types.
9. Cable hook (J-hook) support systems.
10. Cable television/broadband distribution system.
11. Cable tray systems.
12. Classroom Amplification Systems.
13. Conduit and associated fittings.
14. Dance and gymnastics sound reinforcement systems.
15. Disconnect /safety switches.
16. Distribution switchboard(s).
17. Door Access Video Entry System.
18. Dry type transformers.
19. Emergency/standby engine generator set, remote annunciator panel, and automatic transfer switch(es).

20. Enclosed circuit breakers.
21. Feeder type busway.
22. Fire detection and alarm system.
23. Fuses and spare fuse cabinet.
24. Generator quick connect switchboard.
25. Grounding system, including rods, connectors, and welds.
26. Gymnasium sound reinforcement system.
27. Lighting control systems.
28. Lighting fixtures including lamps, ballasts, and poles.
29. Lighting occupancy sensors.
30. Master clock system.
31. Middle School stage performance lighting controls and lighting.
32. Multi-media systems.
33. Motor control centers.
34. Panelboards, including distribution and branch circuit.
35. Rooftop conduit support system.
36. School zone warning signals.
37. Security intrusion system.
38. Sound and intercommunications and program system.
39. Sports field lighting systems.
40. Surface metal raceways and fittings.
41. Surge protective devices.
42. Telecommunications system including outlets, equipment racks, and cables.
43. Television studio performance lighting controls and lighting.
44. Track Busway System
45. Wireless master clock system.
46. Wires, cables, and connectors.
47. Wiring devices.

L. No item or system listed in the schedule above shall be delivered to the site or installed until successful completion of the review. After review of the proposed materials has been successfully completed, no substitution shall be permitted except where approved by the Architect/Engineer in writing. Should the Contractor fail to comply with the requirements of this paragraph, the Owner reserves the right to select any and all items and systems required

by this Specification. Materials so selected shall be used in the work at no additional expense to the Owner.

M. The successful review rendered on shop drawings shall not be considered as a guarantee of building conditions. Where shop drawings have been successfully reviewed, said review does not mean that the drawings have been checked in detail and does not in any way relieve the Contractor from the responsibility, nor the necessity of furnishing the material or performing the work as required by the Drawings and Specifications.

N. Failure to submit shop drawings that meet the requirements of the Drawings and Specifications in ample time for review shall not entitle the Contractor to an extension of contract time, and no claim for extension by reason of such default shall be allowed.

O. All equipment and materials to be furnished under this Division of these Specifications shall be as manufactured by the manufacturer(s) listed on the Drawings or herein specified. All requests by any bidder to provide equipment and/or material manufactured by a manufacturer not listed on the Drawings or specified herein, including equipment identified as “OR EQUAL” to a listed manufacturer, must be submitted to the Architect/Engineer not less than ten (10) calendar days prior to the bid date. Any and all replies to said requests will be made in the form of an addendum which shall be made available to all bidders. Any equipment and/or materials installed by this Contractor not manufactured by a specified manufacturer or covered under an addendum shall be removed by this Contractor and the proper equipment or materials installed at no additional expense or delay to the Owner.

P. This contractor shall furnish to the Owner, after approval of shop drawings, three (3) wiring sample boards. Each sample board shall be made of minimum space ½” thick plywood and sized as required to accommodate all wiring samples. Each board shall be painted white and shall have samples of fire alarm, all sound reinforcement systems (divided by system), multi-media, security, CATV, door access video entry, and telecommunications wiring. Each wiring sample shall be a minimum of 6 inches long with the manufacturer and model number clearly visible. Each wiring sample shall be properly labeled for its intended purpose using a labeling machine.

VI. Equipment Deviations

A. Where this Contractor proposes to use, and/or uses, an item of equipment other than that specified or detailed on the Drawings, which requires any redesign of any other part of the electrical, mechanical, or architectural layout, all such redesign and all new drawings and detailing required shall be prepared by this Contractor at no additional expense to the Owner and shall be reviewed by the Architect/Engineer.

B. Where such approved deviation requires a different quantity and arrangement of duct work, piping, wiring, conduit, and equipment, this Contractor shall furnish and install any such duct work, piping, structural supports, insulation, controllers, motors, starters, electrical wiring and conduit, and any other additional equipment required by the system at no additional expense to the Owner.

VII. Qualifications For Bidders

A. This Contractor shall examine drawings and Specifications relating to the work of all trades and become fully informed as to the extent and character of work required and its relation to all other work in the project prior to submission of bid or prior to the start of any construction.

B. Before submitting bid, this Contractor is encouraged to visit the site and examine all adjoining existing buildings, equipment, and space conditions including areas above accessible ceilings on which his work is in any way dependent, for the best workmanship and operation according to the intent of the Specifications and Drawings. This Contractor shall verify dimensions and become fully informed as to the nature and scope of the proposed work and also the conditions under which it is to be conducted. This Contractor shall report to the Architect/Engineer any conditions which, in their estimation, might preclude them from installing the equipment and work in the manner as intended and noted on the Drawings and in this Specification. Failure to take the above precaution shall in no way relieve this Contractor from his obligation to provide the material and work as indicated and as specified at no additional expense to the Owner within the stipulated completion time period.

C. No consideration or allowance shall be granted for failure to visit the site, or for any alleged misunderstanding of materials to be furnished, or work to be done, it being agreed that tender of proposal carried with it agreement to items and conditions referred to herein or indicated in the Drawings.

VIII. Temporary Facilities:

A. Temporary facilities shall be as specified under SECTION 01510 TEMPORARY UTILITIES. Requirements therein are hereby made a part of this Section as if fully specified herein.

B. Contractor shall coordinate with the construction phasing of the building in order for this contractor to provide power and systems cabling and devices for the temporary relocation of the existing administrative offices, media center and other essential school operational areas as directed by the Owner.

IX. Drawings

A. The Drawings are diagrammatic and indicate the general arrangement of systems and work included in the Contract. Do not scale the drawings. Consult the Drawings for the exact location of fixtures and equipment. Where same are not definitely located, this Contractor shall obtain this information from the Architect/Engineer.

B. This Contractor shall follow the Drawings in laying out work and check the Drawings of other trades to verify spaces in which work is to be installed. This Contractor shall maintain maximum headroom and space conditions at all points. Where headroom or space conditions appear inadequate, this Contractor shall notify the Architect/Engineer before proceeding.

C. This Contractor shall call to the attention of the Architect/Engineer of any conflicting information in the Contract Drawings and/or Specifications, by letter or Request for Information (RFI) process. Contractor shall not proceed in error. Conflicts must be resolved.

D. If directed by the Architect/Engineer, this Contractor shall, at no additional expense to the Owner, make reasonable modifications in the layout as needed to prevent conflict with other trades for proper execution.

E. When failure by this Contractor to comply with the work set forth in the above paragraphs results in a conflict, the work shall be modified by this Contractor as directed by the Architect/Engineer at no additional expense to the Owner.

X. Contractor's Warranty

A. This Contractor shall warrant the workmanship, materials, and equipment against defects and/or non-operation as described in SECTION 01740 WARRANTIES AND BONDS.

XI. Cooperation With Other Trades

A. This Contractor shall give full cooperation to other trades and shall furnish in writing to the Architect/Engineer any information necessary to permit the work of all trades to be installed satisfactorily with the least possible interference or delay.

B. Where the work of this Contractor will be installed in close proximity to work of other trades, or where there is evidence that work shall interfere with the work of other trades, this Contractor shall assist in working out space conditions to make a satisfactory adjustment. This Contractor shall prepare composite working drawings at a scale not less than 1/4 inch equals 1'-0", clearly showing how the work is to be installed in relation to the work of the other trades. If this Contractor installs the work before coordinating with other trades or as to cause any interference with work of other trades, this Contractor shall make necessary changes to the work to correct the condition at no additional expense to the Owner.

C. This Contractor shall furnish to other trades, all necessary templates, patterns, setting plans, and shop details for the proper installation of the work and for the purpose of coordinating adjacent work.

Part 2 - Products

I. Standard Products

A. Unless otherwise shown on the Drawings or herein specified, each item of equipment furnished by this Contractor shall be essentially the standard product of the manufacturer. Where two (2) or more equipment items of the same kind or class or equipment are required, they shall be the product of a single manufacturer.

B. For equipment consisting of an assembly of multiple components, such multiple components do not have to be the products of a single manufacturer.

II. Performance Data

A. All performance data specified herein shall be considered actual performance of equipment as installed. If installation details are such that actual operating conditions unfavorably affect performance as compared to conditions under which the equipment was rated, suitable allowance shall be made by this Contractor.

III. Quiet Operation

A. All equipment, including the emergency engine generator set, shall operate under all conditions of load without transmission of sound and/or vibration which is found to be objectionable in the opinion of the Architect/Engineer. In case of sound or vibration noticeable outside of the room or space in which it is installed, or annoyingly noticeable inside its' own room or space, it shall be considered objectionable. Sound or vibration eliminators as recommended to eliminate any objectionable sound or vibration shall be furnished and

installed by this Contractor if deemed necessary by the Architect/Engineer.

IV. Electrical Work
   A. All electrical motors for plumbing and mechanical equipment shall be furnished and installed under Division 23.
   B. All starters and phase failure relays required for equipment shall be furnished under Division 15, and shall be installed and wired under this Division of these Specifications.
   C. All other electrical devices such as variable frequency drives (VFD), pushbutton stations, selector switches, flow switches, pilot lights, thermostats, etc., for the control or operation of mechanical and plumbing equipment shall be furnished and installed under Division 15. These items shall comply with all Sections of this Division of these Specifications.

Part 3 - Execution

I. Installation Of Work
   A. This Contractor shall examine the site and all Drawings before proceeding with the layout and installation of this work.
   B. This Contractor shall arrange the work essentially as shown on the Drawings, exact layout shall be made on the job to suit actual conditions. This Contractor shall confer and cooperate with other trades on the job so all work shall be installed in proper relationship. Precise location of parts to coordinate with other work shall be the responsibility of this Contractor.
   C. This Contractor shall arrange for required sleeves and openings. This Contractor shall be liable for cutting or patching made necessary by failure to make proper arrangements in this respect.
   D. This Contractor shall provide a full-time Job Foreman who shall oversee and coordinate the work with other trades and make proper layout of the work to suit the job conditions and to satisfy the general requirements of the Contract.

II. Delivery And Storage
   A. All materials and equipment shall be delivered in the manufacturer's original packages with seals unbroken and with manufacturer's name and contents legibly marked thereon. This Contractor shall store all materials off the ground, under cover, and protected from the weather and construction.

III. Scaffolding, Rigging, And Hoisting
   A. Unless otherwise specified, this Contractor shall furnish all scaffolding, rigging, hoisting, shoring, and services necessary for the erection and delivery into the premises of any equipment and apparatus furnished and removal of same from premises when no longer required.

IV. Excavating And Backfilling
   A. Mass excavation to approximate building level shall be carried out under DIVISION 1 of these Specifications. This Contractor shall do all trench and pit excavation and backfilling required for the electrical work inside and outside the building, including: repairing of finished surfaces; all required shoring, bracing, pumping; re-stripping; and all protection of safety of persons and property. The method of backfilling shall conform to the requirements of Prince George’s County. In addition, it shall be the responsibility of this Contractor to check the indicated elevations of utilities entering and leaving the building. If such elevations require excavations lower than the footing levels, the Architect/Engineer shall be notified of such conditions and redesign shall be made before excavations are commenced. It shall also be the responsibility of this Contractor to make the excavations at the minimum required depths in order not to

undercut the footings.

B. Conduits installed below the ground floor level shall have the bottom of the trench excavated to grade so that the conduit shall rest on a solid bed of undisturbed earth. If rock is encountered, the trench shall be excavated to not less than three (3) inches below required grade and filled to required grade with sand so as to provide a solid bed under the entire length of conduit.
C. Where the trench is excavated below the required depth, the trench shall be filled with sand and fine gravel so that the entire length of conduit rests on solid bed of sand.
D. Backfilling to one (1) foot above the top of the conduit pipe shall be done by hand, using clean dirt free of rocks or other debris. All backfill shall be properly compacted in accordance with DIVISION 2 of this Specification. Utility tracing tape shall be placed by this Contractor above underground electrical work approximately one (1) foot below finished grade for the entire length of the installation.

V. Accessibility
A. This Contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate thickness of partitions, and the adequate clearance in double partitions and hung ceilings for the proper installation of the work. This Contractor shall cooperate with all other trades whose work is in the same space, and shall advise each trade of their requirements. Such spaces and clearances shall, however, be kept to the minimum size required.
B. This Contractor shall locate all equipment that must be serviced, operated, or maintained in fully accessible positions. This equipment shall include, but not be limited to, disconnect switches, panelboards, transformers, controllers, switchgear, motor control centers, generators, junction boxes and pillboxes, and the like. If required for better accessibility, this Contractor shall furnish access doors or panels for this purpose. Minor deviations from the Drawings may be made to allow for better accessibility, and all changes shall be approved by the Architect/Engineer.
C. This Contractor shall furnish and install access panels as required for access to junction boxes, etc. The panels shall be twelve (12) inches square, unless otherwise required to be larger, with hinged metal door and metal frames. Door and frame shall be not lighter than sixteen (16) gauge sheet steel. Access panels shall be the flush type with screwdriver latching device. The frame shall be constructed so that it can be secured to the building material. Access panels and their locations shall meet with the approval of the Architect/Engineer.

VI. Demolition
A. This Contractor shall perform all demolition work as shown on the Drawings and specified herein.
B. The procedures used for the accomplishment of demolition work shall provide for safe conduct of the work, careful removal and disposition of material specified to be salvaged, protection of property which is to remain undisturbed, coordination with other work in progress, and timely disconnection of utility services.
C. Work shall be performed in sequence, locations, and time periods as agreed to by the Owner prior to commencement of work.
D. The amount of dust resulting from demolition shall be controlled to avoid creation of a nuisance in the surrounding area. Masks shall be worn for protection against dust inhalation by all persons in the vicinity of work involving removal of masonry.
E. Protection of existing work:

1. Existing work and finishes to remain shall be protected from damage. Work damaged by this Contractor shall be repaired to match existing work at no additional expense to the Owner.
2. This Contractor shall cover equipment as necessary to protect it from dust.
3. Floors shall be protected by this Contractor from damage.
4. At the end of each workday and during inclement weather, this Contractor shall close exterior openings with weatherproof covers.
5. At the end of each workday this Contractor shall broom clean the entire project.

F. This Contractor shall comply with all Federal and local regulations pertaining to environmental protection.

G. Existing equipment and materials shall be dismantled and/or cut-up so as to be removable through existing access passages. No alterations to the building shall be made for the purpose of removing existing equipment and material.

H. All equipment removed shall remain in the property of the Owner and shall be stored or disposed of as directed.

I. Clean-up:
1. This Contractor shall remove debris and rubbish from the site. Do not allow to accumulate in building or on site.
2. This Contractor shall remove and transport debris in a manner so as to prevent spillage on site or adjacent areas.
3. Local regulations regarding hauling and disposal shall apply.

J. Modifications to Existing Electrical Systems:
1. This Contractor shall ensure that all demolition and modifications to existing electrical systems and associated equipment shall be by a qualified electrician.
2. This Contractor shall remove such existing work as called for on the Drawings and/or as required to clear the areas for new construction. Remove each item of equipment, devices including low voltage devices, luminaires (lighting fixtures), etc. and it's associated circuitry back to the source of power (switchboard, panelboard, controller, control panel, equipment rack, etc.). Associated circuitry includes conduit, conductors, boxes, wiring devices, cover plates, lamps, ballasts, wireways, switches, starters, etc. which are associated with the item being removed.
3. Except as otherwise noted on the Drawings, all existing electrical work which will not be rendered obsolete and which may be disturbed due to any changes required under this Contract shall be restored to its original operating condition. Contractor shall make all necessary provisions to maintain ALL electrical systems, including communications and other low voltage systems, by extending wiring, conduit, relocating equipment, installing new temporary equipment and/or wiring, etc.
4. Electrical work or material rendered obsolete shall be abandoned where concealed in walls and floor slabs and removed where exposed, and/or where made exposed by the removal of walls and/or ceilings. Where a concealed conduit is abandoned and the terminated end is exposed above an accessible ceiling the end shall be capped or sealed in an approved manner. Where a concealed abandoned conduit is terminated in a finished space the conduit shall be removed to below the finished surface (minimum three inches for concrete floor slabs) and the void filled with non-shrinking grout and finished to match the surrounding surfaces.
5. Unused flush device outlet boxes or junction boxes shall be provided with blank cover

plates.

6. Where equipment is identified, or required to be relocated its associated circuitry shall also be removed, as herein before described, along with its associated devices, etc. Provide all electrical connections to the relocated equipment to new or extended circuitry as indicated on the Drawings and/or required to make the equipment fully functional.
7. Power, communications and other low voltage systems that will be reconnected or extended permanently or temporarily shall be identified and marked above the ceiling during the demolition and phased construction periods.
8. Where existing electrical work interferes with new work, and where such installations are to remain in use, the installation shall be disconnected and/or reconnected to coordinate with the work indicated on the Drawings and as herein specified.
9. Except as otherwise indicated, panelboard cabinets shall not be used for other purposes than circuit protection and distribution points and shall not be used as junction or pullboxes.

VII. Cutting And Patching

A. All cutting and patching of existing construction required for work under this DIVISION of these Specifications shall be performed by this Contractor in accordance with SECTION 01045 CUTTING AND PATCHING.

VIII. Personnel Instruction And Operating Instructions

A. This Contractor shall furnish to the Architect/Engineer for delivery to the Owner, four (4) bound and indexed copies of an approved operations and maintenance instruction booklet along with a copy of the submittal data for each item of equipment installed under this Contract. The submittal data shall include all low voltage “special systems” drawings and floor plans, updated to include any deviations to the system(s) and/or the building layout to properly reflect “as built” conditions.
B. After all tests are conducted and approved as specified below, this Contractor shall furnish a competent operations engineer for a period of two (2) days to instruct and demonstrate to the Owner, or his authorized representative, the operation of each system. This Contractor shall notify the Architect/Engineer in writing of the person to whom this instruction was given and the date given. This Contractor shall provide at least one (1) weeks’ notice to the Owner when conducting tests or demonstrations of equipment.
C. This Contractor shall furnish to the Owner as part of the Owner's operating and personnel instruction package, one (1) bound set of marked up drawings indicating any changes made during construction to the original contract drawings. The set shall be clearly labeled, "As Built Plans."
D. This Contractor shall furnish complete Technical Service Manuals with component schematics and parts lists as indicated in appropriate section for each system.

IX. Equipment Suppliers Inspection

A. The following equipment and systems shall not be placed in operation until a competent installation and service representative of the manufacturer has made an on the job inspection of the installation, has certified that the equipment is properly installed and lubricated, that preliminary operating instructions have been given, and that equipment is ready for operation.
   1. Athletic fields sound reinforcement systems.
   2. Auditorium lighting controls and performance lighting systems.
   3. Auditorium sound reinforcement system.
   4. Auxiliary sound and reinforcement systems.

5. Band, Orchestra, and Choral rooms sound reinforcement systems.
6. Black Box Theater lighting controls and performance lighting systems.
7. Black Box Theater sound reinforcement system.
8. Cable television/broadband distribution system (CATV).
9. Classroom amplification systems.
10. Dance and gymnastics sound reinforcement systems.
11. Door access video entry system.
12. Emergency engine generator set and automatic transfer switch(es).
13. Fire detection and alarm system.
14. Gymnasium sound reinforcement system.
15. Lighting control systems.
16. Master clock system.
17. Middle School stage performance lighting controls and lighting.
18. Multi-media systems.
19. School zone warning signals.
20. Security intrusion system.
21. Sound, intercommunications and program systems.
22. Sports fields lighting systems, including fixture aiming.
23. Telecommunications system including networking equipment.
24. Television studio lighting controls and performance lighting systems.
25. Wireless master clock system.

X. Tests

A. This Contractor shall, at his expense, conduct a capacity and general operating test on each system. The test shall demonstrate the specified capacities of the various pieces of equipment, and shall be conducted in the presence of the Architect/Engineer and the Owner. The general operating tests shall demonstrate that the entire equipment system is functioning in accordance with the Drawings and Specifications. This Contractor shall furnish all instructions, test equipment, and utilities.

B. After all systems are completely tested, this Contractor shall submit four (4) copies of the test results to the Architect/Engineer for review. Final inspection shall not be made until test results have been reviewed by the Architect/Engineer.

XI. Cleaning

A. This Contractor shall thoroughly clean all electrical equipment installed under this DIVISION of these Specifications after the system has been completed or used for temporary service, but in any case, prior to final inspection by the Owner's representatives.

B. Cleaning shall include, but not be limited to, luminaires (lighting fixtures), wiring devices, cover plates, distribution equipment, and the like.

XII. Guarantee

A. This Contractor shall guarantee by acceptance of the contract that all work installed shall be free from any and all defects in workmanship and/or materials, and that all apparatus shall develop capacities and characteristics specified, and that if during the phased construction and warranty period such defects in workmanship, materials, or performance appear, this Contractor shall with no additional expense to the Owner, remedy such defects within a reasonable time. In default thereof, Owner may have such work done and charge the cost to this Contractor.

XIII. Identification

A. This Contractor shall furnish an "As-Built" power systems riser diagram indicating service entrance switchboard, panelboards, emergency engine generator set, automatic transfer switch, dimming systems, and safety switches. Diagram shall indicate size of feeders and conduit, breakers, circuit, and fuses. The diagram shall be neatly drawn, using mechanical drafting methods, at least 24 inches x 36 inches, laminated, and hung from the wall adjacent to service entrance switchboard as directed by the Owner.

B. This Contractor shall refer to the appropriate sections of these Specifications for identification requirements for junction boxes, branch and feeder conductors, underground wiring, low voltage special systems wiring and the like.

XIV. Lock-out/tag-out Procedures

A. This Contractor shall have an established lock-out/tag-out procedure which meets the requirements of VOSH Standard 29 CFR Part 1910, Subpart J, Subsection 147, entitled "Control of Hazardous Energy Sources". This Contractor shall coordinate with the Owner's representative to insure conformance with the Owner's lock-out/tag-out program requirements.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work under this Section shall consist of furnishing and installing grounding systems as shown on the Drawings and herein specified.

III. SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

B. Shop Drawings:

1. Indicate proposed arrangement for signal reference grids. Include locations of items to be bonded and methods of connection.

2. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

3. Field quality control test reports.

4. Project Record Documents: Record actual locations of grounding electrode system components and connections.

IV. QUALITY ASSURANCE

A. All equipment, materials, and their installation shall conform to the requirements of the National Electrical Code (NEC), local code requirements, and these Specifications.

B. All equipment and material shall be listed by Underwriter's Laboratories, Inc. (UL) for their intended use and shall bear the UL label.

C. Equipment shall be constructed in accordance with National Electrical Manufacturer's Association (NEMA) standards.

D. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

E. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

V.

A. Installer Qualifications for Signal Reference Grids: Company with minimum five years documented experience with high frequency grounding systems.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

VI. DESCRIPTION

A. The equipment grounding system shall be designed so all building steel, metallic structures, raceways, enclosures, cabinets, machine frames, junction boxes, outlet boxes, portable equipment, and all other conductive items in close proximity with electrical circuits operate continuously at ground potential providing a low impedance path for possible ground fault currents.

VII. DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

Part 2 - Products

I. MATERIALS AND COMPONENTS

A. MAIN GROUNDING SYSTEM:

1. The ground bus in the main distribution switchboard shall be connected to at least three (3) copper-clad ground rods, not less than 3/4 inches in diameter, ten (10) feet long, and driven full length into the ground outside in unpaved earth. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area. Where required to meet the requirements of herein specified tests, extra rods shall be installed at no additional cost to the Owner. Provide ground access well for each electrode. The rods shall be located a minimum of ten (10) feet from each other, or any other electrode, and shall be loop interconnected with each other by a minimum No. 4/0 AWG bare copper conductor thermal welded, using the proper style mold, to each rod below grade.

2. Provide a minimum No. 4/0 AWG green insulated copper ground conductor from the main distribution switchboard ground bus to the main metallic water service entrance (before the first pipe joint inside the building) and connect to same by means of adequate ground clamps. Where a dielectric main water fitting is installed, this ground conductor shall be connected to the street side of the dielectric water fitting. The conduit shall be bonded to the ground conductor at each end. Furnish and install with ground clamps, a minimum No. 4/0 AWG

jumper around the water meter.

3. Provide a secondary building ground bar to serve as part of the building grounding electrode system in each electric room and other utilitarian areas of the building where dry-type transformers will be located, and in each communication room and/or where telecommunications main distribution frames (MDF) and sub-distribution frames (SDF) will be located. A ground bar(s) shall also be located at the telephone and CATV service entrance demarcation point(s). The ground bar(s) shall be electro-tin plated copper, minimum size of ¼" x 6" x 12" or larger sizes as shown on the Drawings or required, with 3/8" plastic standoff insulators bolted to the wall. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated. These ground bars shall be connected with a continuous No. 4/0 AWG bare copper ground conductor using high compression two (2) hole lugs. The No. 4/0 AWG ground conductor shall originate at the main switchboard ground bus and route through the building corridor ceilings unspliced to each of the ground bars. Provide "low smoke" type exothermic welds in an accessible ceiling using the proper style mold. Where impractical to use an exothermic weld due to space constraints, the Contractor may use an irreversible compression type connection listed for the purpose but only at locations approved by the Owner.

4. Steel framed buildings:

    a) Provide a secondary building ground bar to serve as part of the building grounding electrode system in each electric room and other utilitarian areas of the building where dry- type transformers will be located, and in each communication room and/or where telecommunications main distribution frames (MDF) and sub-distribution frames (SDF) will be located. A ground bar(s) shall also be located at the telephone and CATV service entrance demarcation point(s). The ground bar(s) shall be electro-tin plated copper, minimum size of ¼" x 6" x 12" or larger sizes as shown on the Drawings or required, with 3/8" plastic standoff insulators bolted to the wall. These ground bars shall be connected with a continuous No. 4/0 AWG bare copper ground conductor using high compression two (2) hole lugs. The No. 4/0 AWG ground conductor shall originate at the nearest accessible building steel beam or column using a "low smoke" type exothermic weld with the proper style mold. Remove the building steel paint completely prior to making grounding connections and repaint with proper galvanized paint when complete.

    b) Bond the building steel at each building expansion joint with No. 4/0 AWG bare copper using a "low smoke" type exothermic weld using the proper style mold at accessible locations. Remove the building steel paint completely prior to making grounding/bonding connections and repaint with proper galvanized paint when complete.

5. New Buildings, Building Additions and Exterior Electrical Equipment Enclosures:

a) Buildings with new concrete foundations and/or footings shall be provided with a minimum No. 4 AWG bare copper ground conductor from the main distribution switchboard ground bus to the foundations and/or footings concrete-encased electrode rebar meeting the requirements of NEC 250.52(A)(3). The conductor shall be thermal welded to the concrete-encased electrode (rebar), using the proper style mold. Refer to the detail on the Drawings. (ENGINEER EDIT OUT THIS PORTION IF NOT USING) Building additions foundations and/or footings not within a reasonable distance from the switchboard may have the concrete- encased electrode bonded to the buildings secondary building electrode system ground bar.

b) Exterior electrical equipment enclosures with new concrete foundations and/or footings shall be provided with a bare copper ground conductor from the ground rods (if provided) and/or from the ground bus of the main panel within the enclosure to the concrete-encased electrode, meeting the requirements of NEC 250.52(A)(3), as shown on the Drawings. The conductor shall be thermal welded to the concrete-encased electrode (rebar), using the proper style mold. The enclosure, if metal, shall be bonded to the grounded electrode.

c) STEEL FRAMED BUILDING: Steel frame buildings shall also have the steel columns anchor bolt connected to the concrete-encased electrode (rebar) with a No. 4/0 AWG bare copper ground conductor having an exothermic weld at both ends, using the proper style molds. Coordinate the installation of the anchor bolts to the base plate to scrape away paint/rust prior to the installation of the washer and nut to the steel columns anchor bolts. Refer to the detail on the Drawings.

B. Secondary services shall be grounded on the "line" side in accordance with the NEC. The neutral disconnecting link, or links, shall be located so that the main distribution switchboard neutral bus with all interior secondary neutrals can be isolated from the common ground bus and the service entrance conductors.

C. The equipment grounding conductors and straps shall be sized in compliance with the NEC. All equipment grounding conductors shall be provided with green insulation equivalent to the insulation on the associated phase conductors. The related feeder and branch circuit grounding conductors shall be connected to the ground bus with pressure connectors. A feeder serving several panelboards shall have a continuous grounding conductor which shall be connected to each related cabinet ground bus.

D. This Contractor shall furnish and install a separate green insulated equipment grounding conductor for each single or three-phase feeder and each branch circuit with a two-pole or three-pole protective device. The required grounding conductor shall be installed in the same raceway with the related phase and/or neutral conductors. Where there are parallel feeders installed in more than one raceway, each raceway shall have a green insulated equipment ground conductor. Single-phase branch circuits required for 120

and 277-volt lighting, receptacles, and motors shall consist of phase and neutral conductors installed in a common metallic raceway, which shall serve as the grounding conductor. Flexible metallic conduit equipment connections utilized in conjunction with the above single-phase branch circuits shall be provided with suitable green insulated grounding conductors connected to grounding terminals at each end of the flexible conduit.

E. This Contractor shall furnish and install in the same raceway with the associated phase and/or neutral conductors, a green colored equipment ground conductor having the same type insulation and connected as described below:

1. Where electrical devices, such as heaters, are installed in air ducts, provide a green insulated equipment ground conductor sized in accordance with the NEC based on the rating of the overcurrent device supplying the unit. This conductor shall be bonded to the ground bus in the associated panelboard.

2. From the equipment ground bus in panelboards through raceways and flexible metallic conduit to ground terminal in a connection box mounted on three-phase motors, furnish and install a ground conductor sized as herein specified. Where the motor has a separate starter and disconnecting device, the ground conductor shall originate at the ground bus in the panelboard. Motors shall be bonded to each starter and disconnecting device enclosure.

II. GROUNDING AND BONDING COMPONENTS

A. General Requirements:

1. Provide products listed, classified, and labeled as suitable for the purpose intended. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding,

1. Use insulated copper conductors unless otherwise indicated.

2. Exceptions:

a) Use bare copper conductors where installed underground in direct contact with earth.

b) Use bare copper conductors where directly encased in concrete (not in raceway).

3. Factory Pre-fabricated Bonding Jumpers: Furnished with factory-installed ferrules; size braided cables to provide equivalent gage of specified conductors.

C. Connectors for Grounding and Bonding:

1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.

2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.

3. Exceptions:

    a) Use mechanical connectors for connections to electrodes at ground access wells.

    b) Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.

    c) Use exothermic welded connections for connections to metal building frame.

D. Mechanical and Compression Connectors:
    1. Manufacturers

        a) Advanced Lightning Technology (ALT): www.altfab.com.

        b) Burndy LLC: www.burndy.com.

        c) Harger Lightning & Grounding: www.harger.com.

        d) Thomas & Betts Corporation: www.tnb.com.

        e) Substitutions: See Section 16010 – Electrical General Provisions

E. Exothermic Welded Connections:
    1. Manufacturers

        a) Burndy LLC: www.burndy.com.

        b) Cadweld, a brand of Erico International Corporation: www.erico.com.

        c) thermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com.

F. Ground Bars:

    1. Description: Copper rectangular ground bars with mounting brackets and insulators.

    2. Size: As indicated.

3. Holes for Connections: As indicated or as required for connections to be made.

4. Manufacturers:

    a) Advanced Lightning Technology (ALT): www.altfab.com.

    b) Erico International Corporation: www.erico.com.

    c) Harger Lightning & Grounding: www.harger.com.

    d) thermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com.

    e) Substitutions: See Section 16010 – Electrical General Provisions

G. Ground Rod Electrodes:

1. Comply with NEMA GR 1.

2. Material: Copper-bonded (copper-clad) steel.

3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.

4. Where rod lengths of greater than 10 feet are indicated or otherwise required, sectionalized ground rods may be used.

5. Manufacturers:

    a) Advanced Lightning Technology (ALT): www.altfab.com.

    b) Erico International Corporation: www.erico.com.

    c) Galvan Industries, Inc: www.galvanelectrical.com.

    d) Harger Lightning & Grounding: www.harger.com.

    e) Substitutions: See Section 16010 – Electrical General Provisions

H. Ground Plate Electrodes:

1. Material: Copper.

2. Size: 24 by 24 by 1/4 inches, unless otherwise indicated.

3. Manufacturers:

    a) Advanced Lightning Technology (ALT): www.altfab.com.

b) Erico International Corporation: www.erico.com.

c) Harger Lightning & Grounding: www.harger.com.

d) thermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com.

e) Substitutions: See Section 16010 – Electrical General Provisions

Part 3 - Execution

I. POWER SYSTEM GROUNDING

A. This Contractor shall furnish and install green insulated ground conductor(s) in a raceway to the main ground and domestic metallic water main with ground clamps designed specifically for that purpose.

B. Main distribution system: From the ground electrodes, this Contractor shall furnish and install an insulated ground conductor to the ground bus within the switchgear, to the neutral of the switchgear, and to all non-current carrying parts.

C. Secondary building grounding: Furnish and install secondary building ground bars where indicated and as detailed on the drawings. Connect the ground bars with No. 4/0 AWG bare copper ground conductors originating from the (switchgear ground bus) (building steel). Provide green tags on the ground conductors every fifty (50) feet or less. The tags shall identify the ground conductor as the building secondary grounding electrode system. Laminate tags and secure with tie wraps.

D. Branch circuit grounding: This Contractor shall furnish and install grounding bushings, ground terminal blocks, and grounding jumpers at distribution centers, pullboxes, panelboards, and the like.

E. Bonding jumpers: This Contractor shall furnish and install a green insulated bonding conductor (size shall be correlated with the over-current device protecting the conductor) attached to grounding bushings on the raceway, to lugs on boxes, and other enclosures.

F. Bonding conductors: This Contractor shall furnish and install a bonding conductor in all flexible conduits connected at each end to a grounding bushing.

G. Pole mounting luminaire (lighting fixture) grounding: This Contractor shall furnish and install a ground conductor with green insulation to the lighting standard (pole). Connect to a corrosion-resistant ground stud or ground clamp furnished as part of the standard. The ground conductor shall originate and be run with the branch circuit wiring.

H. All electrical outlets shall be connected from the device grounding terminal to the outlet

box with No. 12 AWG green insulated conductor. This Contractor shall furnish and install a green screw terminal in the outlet box and a continuous green ground conductor from the green terminal screw to the grounding systems as indicated on the Drawings.

II. EXAMINATION

1. Verify that work likely to damage grounding and bonding system components has been completed.

2. Verify that field measurements are as indicated.

3. Verify that conditions are satisfactory for installation prior to starting work.

III. COMMUNICATION GROUNDING

A. Telephone

1. This Contractor shall furnish and install one (1) No. 2 AWG green ground conductor in a ¾ inch raceway from the telephone equipment demarcation space to the main service ground or building secondary grounding electrode system.

2. This Contractor shall furnish and install one (1) No. 2 AWG type green ground loop between each raceway terminating at the telephone equipment demarcation backboard by means of a grounding bushing.

B. Fire detection and alarm systems: This Contractor shall furnish and install one (1) No. 8 AWG green ground conductor in a 3/4-inch raceway from system equipment enclosures to the main service ground or building secondary grounding electrode system.

C. Ancillary communication systems: Provide additional grounding of other building systems as described elsewhere in these specifications.

IV. TESTS

A. The completed grounding system shall be subjected to a ground resistance test with an earth test megger to ensure that the ground resistance, without chemical treatment or other artificial means, does not exceed five (5) ohms at the service entrance equipment's ground bus. The Contractor shall furnish and install additional ground rods and conductors from the exterior ground grid to achieve the required resistance to ground. Testing equipment must be calibrated to the manufacturer's requirements. Upon request, the Contractor shall provide documentation of the testing equipment's most recent calibration.

B. ALL STEEL FRAMED BUILDINGS: In addition to the above, steel framed buildings shall be subjected to a ground resistance test with an earth test megger for the adequacy of the steel framing of the building as a grounding electrode system for five (5) ohms or less. Testing shall be at all of the secondary building ground bar connection points. If

testing results do not meet the required resistance, the engineer must be notified.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall consist of furnishing and installing conduits, raceways, cable trays, and fittings for all systems as shown on the Drawings and herein specified.

III. QUALITY ASSURANCE

A. All equipment, materials, and their installation shall conform to the requirements of the National Electrical Code (NEC), local code requirements, and these Specifications

B. All equipment and materials shall be listed by Underwriters Laboratories, Inc. (UL) for their intended use and shall bear the UL label.

C. Equipment shall be constructed in accordance with National Electrical Manufacturer's Association (NEMA) standards.

D. Submittals are required in accordance with SECTION 260500 of these Specifications for conduits, raceways, fittings, wiring troughs, cable hooks, cable trays and associated support systems.

1. Cable tray submittals shall include product data and drawings of cable tray and accessories including clamps, brackets, hanger rods, splice plate connectors, expansion joint assemblies and fittings showing accurately scaled components.

2. Cable tray product data shall include, but not be limited to, types of materials, finishes, rung spacing, inside depths, and fitting radii. For side rails and rungs, submit cross sectional properties including Section Modulus (Sx) and Moment of Inertia (Ix).

Part 2 - Products

2.1 CONDUITS

A. Minimum conduit size shall be 1/2 inch. No more than six (6) No. 12 AWG conductors shall be pulled in 1/2-inch conduit. For conductors, larger than No. 12 AWG or quantities of No. 12 greater than six (6) conductors, 3/4-inch conduit shall be the minimum size. Other sizes shall be as indicated on the plans, or as required by the NEC for number and size of conductors installed. Materials shall be new and full length. Crushed and/or deformed conduits shall not be used.

B. Rigid steel conduit and intermediate metal (IMC) conduits shall be full weight threaded and galvanized steel pipe of standard pipe dimensions.

C. Electrical metallic tubing (EMT) shall be threadless thin wall conduit, galvanized or zinc metallized.

D. Flexible steel conduit shall be single-strip type, galvanized. Use for short connections where rigid type conduits are impractical, for expansion joint crossing, from outlet box to a recessed luminaire (lighting fixture) (minimum, 4 feet; maximum, 6 feet in length), for final connections to motor terminal boxes or other vibrating equipment. Use only steel connectors approved for flexible conduit. Provide an internal ground wire with proper fittings. Other uses on the project shall not be permitted.

E. Flexible weatherproof conduit shall have polyvinyl sheathing similar to AMERICAN METAL HOSE "Sealtite" type "UA" and shall be used where exposed to the weather to connect all motors; all rooftop mounted equipment, and all other wet locations, where rigid type conduits connections are impractical. Weatherproof flexible conduit installations shall have maximum lengths of + twenty-four (24) inches. Use only steel connectors approved for flexible weatherproof conduit. Provide an internal ground wire with proper fittings. Other uses on the project shall not be permitted, except where indicated hereinafter in these specifications or as shown on the drawings.

F. Plastic conduits shall be installed only underground or in a concrete slab on grade. Only heavywall (Schedule 40) plastic conduit shall be used. Where conduit turns out of a concrete slab or finished grade, inside or outside the building, provide a rigid steel conduit elbow and suitable adaptor between plastic and steel conduits. No plastic conduit shall be used inside the building or exposed outside the building, unless otherwise noted on the Drawings.

G. This contractor can use for exterior, underground, pole mounted luminaire branch circuit wiring, schedule 40 high-density polyethylene (HDPE) piping. Where conduit turns out above finished grade, provide a rigid steel conduit elbow and suitable adaptor between plastic and steel conduits. No plastic conduit shall be used exposed outside the building, unless otherwise noted on the Drawings. A HDPE pipe that meets this specification is DURA-LINE Cat. No. EPEC- 40/SCH 40 (black) or approved equal.

2.2 METAL CONDUIT AND TUBING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Electri-Flex Co.
6. Manhattan/CDT/Cole-Flex.

7. Maverick Tube Corporation.
8. O-Z Gedney; a unit of General Signal.
9. Wheatland Tube Company.

B. Rigid Steel Conduit: ANSI C80.1.

C. IMC: ANSI C80.6.

D. EMT: ANSI C80.3.

E. FMC: Zinc-coated steel.

F. LFMC: Flexible steel conduit with PVC jacket.

G. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
2. Fittings for EMT: Set-screw or compression type.
3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with
overlapping sleeves protecting threaded joints.

H. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.3 NONMETALLIC CONDUIT

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Arnco Corporation.
4. CANTEX Inc.
5. CertainTeed Corp.; Pipe & Plastics Group.
6. Condux International, Inc.
7. ElecSYS, Inc.
8. Electri-Flex Co.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT/Cole-Flex.
11. RACO; a Hubbell Company.
12. Thomas & Betts Corporation.

B. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.
C. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.

2.4 FITTINGS

A. Fittings, couplings, and accessories shall be compatible with the conduit material.

B. Unions, couplings, and fittings for rigid and IMC conduits shall be of galvanized steel of conventional dimensions and shall be internally threaded at each end to fit the nontapered thread standard for the corresponding size conduit. Couplings and fittings for electrical metallic tubing shall be of steel and shall be of the compression or setscrew type. Cast pot metal and crimp types are not acceptable.

C. Conduit bodies used with conduits 1 ½ inches and larger shall be galvanized cast iron “mogul conduit bodies” complete with a domed and angled cover, neoprene gasket, stainless steel screws, and rated for “wet locations”.

2.5 BUSHINGS AND LOCKNUTS

A. Use OZ/GEDNEY type 'B' insulated or type 'BLG' bushing where necessary to bond conduit to ground connection. Bushings shall be as manufactured by OZ/GEDNEY, THOMAS & BETTS, or CROUSE-HINDS.

B. Locknuts shall be used on both sides of conduit connections to a box or a panelboard in addition to the bushing. Where a larger size opening occurs than the size of the conduit, use reducing locknuts. Do not use reducing washers.

2.6 WIRING TROUGHS

A. Wiring troughs complete with screwed covers shall be used where indicated and for mounting groups of switches and/or starters. Wiring troughs shall be the standard manufactured product of a company regularly producing wiring troughs and shall not be a local shop assembled unit. Wiring trough shall be UL listed and of sizes indicated or as required by NEC, if not indicated. The interior, including couplings shall be completely open without interference. Finish shall be ASA #49 medium light gray enamel over a rust inhibitor. Wiring troughs shall be UL listed "Suitable For Wet Locations" and so labeled where indicated "WP" on the Drawings.

B. Wiring connection taps within wiring troughs shall be made using clear self- sealing, self-insulating, multi-tap connectors with transparent flexible insulating covers. The connectors shall be securely fastened. The multi-tap connector shall be manufactured by ILSCO, Series “PCT” ClearTap or approved equal.

2.7 CABLE TRAY

A. Ladder type cable tray shall be used where indicated on the Drawings, for low voltage cabling systems. Low voltage cabling systems shall be as hereinafter specified in other

sections of these specifications. Ladder type cable trays may also be used for Type MC Cable as hereinafter specified in other sections of these specifications.

B. Cable tray systems shall be made of straight sections, fittings, and accessories as shown on the Drawings, described herein, and as defined in the latest NEMA standards publication VE-1. Cable tray shall be UL classified as an equipment-grounding conductor.

C. Ladder type cable tray shall be metal (aluminum or pre-galvanized steel) of the types, classes and sizes indicated; with splice plates bolts, nuts and washers for connecting units. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards and these specifications.

D. Cable tray materials and finish shall be as follows:

1. Aluminum: Straight section and fitting side rails and rungs shall be extruded from Aluminum Association Alloy 6063. All fabricated parts shall be made from Aluminum Association Alloy 5052.

2. Pre-Galvanized Steel: Straight sections, fitting side rails, and rungs shall be made from structural quality steel meeting the minimum mechanical properties and mill galvanized in accordance with ASTM A653 SS, Grade 33, Coating Designation G90.

E. Ladder type cable tray shall consist of two (2) longitudinal members (side rails) with transverse members (rungs) welded to the side rails. Rungs shall be spaced six (6) inches on center. Rung spacing in radiused fittings shall be nine (9) inches and measured at the center of the tray's width. Rungs shall have a minimum cable bearing surface of 7/8 inches with radiused edges. No portion of the rungs shall protrude below the bottom plane of the side rails. Each rung must be capable of supporting the cable load, with a safety factor of 1.5, and a 200-lb. concentrated load when tested with NEMA VE 1, section 5.4.

F. Ladder type cable tray shall have an overall side rail height of four (4) inches with a minimum loading depth of three (3) inches. Cable tray width shall be twelve (12) inches, eighteen (18) inches, or twenty-four (24) inches as shown on the Drawings. Straight section side rails shall be of "I-beam" design with a rung retaining weld bead. All straight sections shall be supplied in standard lengths of twelve (12) feet, except where shorter lengths are permitted to facilitate tray assembly lengths as shown on the Drawings. Fittings radius shall be twenty-four (24) inches. Side rails of straight sections and fittings shall be compatible so that standard splice plates can be used to join straight sections and fittings. Fittings shall have three (3) inch tangents beyond the curved section to accommodate the standard splice plates.

G. Splice plates shall be the bolted type made as indicated below for each tray type. The resistance to fixed splice connections between an adjacent section of tray shall not exceed .00033 ohm. Splice plate construction shall be such that a splice may be located anywhere within the support span without diminishing rated loading capacity of

the cable tray.

1. Aluminum Tray: Splice plates shall be made of 6063-T6 aluminum, using four square neck bolts and serrated flange locknuts. Hardware shall be zinc plated in accordance with ASTM B633, SC1.

2. Pre-Galvanized Steel Tray: Splice plates shall be manufactured of high strength steel, meeting the minimum mechanical properties of ASTM A1011 HSLAS, Grade 50, Class 1. Each splice plate shall be attached with ribbed neck carriage bolts and serrated flange locknuts. Hardware shall be zinc plated in accordance with ASTM B633 SC1.

Splice plates shall be furnished with straight sections and fittings.

H. Cable Tray Supports

1. Supports shall be constructed from 12-gauge steel formed shape channel members 1 5/8 inch by 1 5/8 inch with necessary hardware such as trapeze support kits furnished by manufacturer of cable tray (or engineer approved equal). Cable trays installed adjacent to walls shall be supported on wall-mounted brackets furnished by manufacturer of cable tray (or engineer approved equal).

2. Trapeze hanger supports shall be supported by ½ inch (minimum) diameter rods.

3. Cable tray fitting supports shall be located such that they meet the strength requirements of straight sections. Install fitting supports per NEMA VE-2 guidelines, and in accordance with manufacturer's instructions.

I. Accessories shall be furnished as required to protect, support, and install a cable tray system. Accessories shall consist of but not be limited to: section splice plates, expansion plates, blind-end plates, specially designed ladder dropouts, etc.

J. Cable tray shall be capable of carrying a uniformly distributed load of 126 lbs./ft. for aluminum on a 12-ft. support span or 103 lbs./ft for pre-galvanized steel on a 12-ft. support span (NEMA Class 12C) with a safety factor of 1.5 when supported as a simple span and tested per NEMA VE 1, section 5.2. In addition to the uniformly distributed load, the cable tray shall support 200 lbs. concentrated load at mid-point of span. Load and safety factors specified are applicable to both the side rails and rung capacities. Cable tray shall be made to manufacturing tolerances as specified by NEMA.

K. Cable tray manufacturers shall be B-LINE SYSTEMS, INC. Series 24A for aluminum and 248 for pre-galvanized steel or equal as manufactured by WIREMOLD CABLOFIL, CHALFANT CABLE TRAY, COPE CABLE TRAY, SQUARE D, or THOMAS & BETTS CORPORATION.

2.8 CABLE HOOK SUPPORT SYSTEMS

A. Cable hooks (also known as “J” hooks) shall be provided for low voltage cable systems as hereinafter specified in other sections of these specifications.

B. Cable hooks shall provide a flat bottom bearing surface of sufficient width to comply with required bend radii of high-performance cables.

C. Cable hooks shall have flare edges to prevent damage while installing cables.

D. Cable hooks shall be designed so the mounting hardware is recessed to prevent cable damage.

E. Cable hooks sized 1 5/16 inches and larger shall have a stainless-steel cable latch retainer to provide containment of cables within the hook. The retainer shall be removable and reusable and be suitable for use in air handling spaces.

F. Cable hooks shall be factory assembled for direct attachment to walls, hanger rods, beam flanges, purlins, strut, floor posts, etc. to meet job conditions.

G. Multi-tiered cable hook assemblies shall be used where required to provide separate cabling compartments, or where additional capacity is needed. Assemblies may be factory assembled or assembled from pre-packaged kits. Assemblies shall consist of a steel angled hanger bracket holding up to six (6) cable hooks.

H. Cable hooks for non-corrosive areas shall be pre-galvanized steel, ASTM A653. Where additional strength is required, cable hooks shall be spring steel with a zinc-plated finish, ASTM B633, SC3. Cable hooks for corrosive areas shall be stainless steel, AISI Type 304.

I. Cable hooks shall be capable of supporting a minimum of 30 pounds with a safety factor of 3. Spring steel cable hooks shall be capable of supporting a minimum of 100 pounds with a safety factor of 3 where extra strength is required.

J. Cable hook manufacturer shall be B-LINE SYSTEMS, INC. Series BCH21, BCH32, BCH64, or equal as manufactured by ERICO CADDY.

2.9 PULL-LINES (CORDAGE)

A. Pull-lines (rope and cordage) types and strengths must be selected and calculated by the Contractor. The selection must be based on the intended use and expected pulling load applications. Design Factor (DF) selections and Working Load Limits (WLL) must be calculated with consideration of exposures to risk and actual conditions of use for each application. Pull-lines shall be in compliance with the latest Cordage Institute Standards and Guidelines.

B. The minimum pull-line tensile strength for insertion into conduits shall be 500 pounds and of the low-friction type.

C. Each utility service entrance conduit (raceway) for power company, telephone company and/or cable television (CATV) company shall have a MULETAPE® pulling tape with numerical values having sequential footage (feet and inches) markings, without splices. The MULETAPE® shall have a minimum tensile strength of 2500 pounds and shall be of the low-friction type with prelubrication, high abrasion resistant yarns.

D. Where minimum pull-line strengths are given, they do not negate the Contractor's responsibility for proper selections and calculations for higher strength pull-lines to suit the application.

2.10 ROOFTOP CONDUIT SUPPORT STRUT SYSTEM

A. Provide rooftop conduit support strut systems that will absorb thermal expansion and contraction of conduits, thus preventing damage to the roof membrane. This Contractor must select the support strut system's load capacity necessary to carry the weights and sizes of conduits.

B. The conduit support base shall have gently rounded edges to prevent damage to the roof and shall be UV resistant polycarbonate resin or 100% recycled rubber and polyurethane prepolymer, and all other metal parts made of hot-dip galvanized or stainless steel.

C. Conduits shall rest on the strut system made of hot-dip galvanized or stainless steel. Provide fasteners sized for the conduit.

D. Rooftop conduit support system manufacturers shall be MIRO INDUSTRIES, INC. or equal as manufactured by CABLOFIL (CABLO-PORT), COOPER B-LINE (DURA-BLOK™) or approved equal.

Part 3 - Execution

I. CONDUITS

A. Panelboard feeders shall be run in electrical metallic tubing (EMT), galvanized rigid steel conduit, intermediate grade metal conduit, or plastic conduit as described herein.

B. Branch circuit raceways for motors twenty (20) horsepower (or tons) and larger, or a combination of motors totaling twenty (20) horsepower and larger requiring a single point connection shall be EMT, galvanized rigid steel conduit, intermediate grade metal conduit, or plastic conduit as described herein.

C. Branch circuit raceways for motors served by variable frequency drives (VFD) shall be electrical metallic tubing (EMT), galvanized rigid steel conduit, or intermediate grade metal conduit from the load side of the VFD to the line side of the motor. Do not use plastic conduit.

D. Feeders, branch circuits, fire alarm system wiring, and other low voltage systems wiring (required to be in conduit) installed indoors in dry locations shall be run in electrical

metallic tubing (EMT), galvanized rigid steel conduit, or intermediate grade metal conduit above hung ceilings (accessible and non-accessible), in hollow block walls, in furred spaces, in vertical and horizontal pipe chases, and in exposed dry locations as describe herein and other sections of these specifications.

E. Feeders, branch circuits, fire alarm system wiring, and other low voltage systems wiring installed underground, under slab on grade, in concrete, in crawl spaces, or in wet locations shall be run in galvanized rigid steel conduit, intermediate grade metal conduit, or plastic conduit as described herein.

F. Low voltage systems plenum rated wiring or cables run indoors in dry locations shall be in electrical metallic tubing (EMT), galvanized rigid steel conduit, or intermediate grade metal conduit when run above non-accessible ceilings, in hollow block walls, and in exposed dry locations other than communications rooms or in a cable tray. Refer to the respective low voltage systems sections of the specifications for other conduit requirements.

G. Conduits run exposed in boiler rooms, elevator machine rooms, mechanical rooms, pump rooms, fire sprinkler service room, and all other similar spaces, located between the floor and a height of 10’-0” above the finished floor, shall be galvanized rigid steel conduit, or intermediate grade metal conduit as described herein. Conduits above 10’-0” may be EMT, unless otherwise indicated on the Drawings, or required by codes.

II. RACEWAY SYSTEM

A. Raceways shall be continuous from outlet to outlet; from outlet to cabinets, junction boxes, or pullboxes; and secured to all boxes so that each system is electrically continuous from service to outlets. Provide termination of raceways with double lock nuts and bushings.

B. Raceways shall be securely and rigidly supported to the building structure in a neat and workmanlike manner, and wherever possible, parallel runs or horizontal conduit shall be grouped together on adjustable trapeze hangers. Support shall be provided at appropriate intervals not exceeding ten (10) feet with straps, hangers, and brackets specifically designed for the application. Channels shall be 1 inch for 24-inch wide trapeze and 1-1/2 inch for larger than 24 inch. Perforated steel straphangers or tie-wire supports are not acceptable. Conduits installed along wall surfaces shall be supported with galvanized steel brackets specifically designed for conduits and sized for the conduit used. Conduit brackets shall be fastened to the wall using appropriate anchors and screws, the use of drive pins and/or other methods using compressed air or gases are not acceptable. Raceways and supports shall not terminate or be fastened directly to the roof decking. Raceways under roof decking shall not be less than 1½ inches from the nearest surface of the roof decking. Supports attached to structural steel joists shall only be attached within 3” of the joist panel points, top or bottom. Supports attached beyond 3” of the joist panel points must be approved, in writing, by the Structural Engineer of record and the Owner before attaching.

C. Run exposed raceways parallel with or at right angles to walls. In mechanical rooms and similar utilitarian spaces where exposed conduits are used, provide "condulets",

and similar fittings in lieu of junction boxes. Exposed outlet boxes of adequate size, however, shall be used to contain wire junctions.

D. No raceway shall be installed within three (3) inches of hot water pipes, or appliances, except at crossings where raceway shall be at least one (1) inch from pipe cover.

E. Install raceway to prevent collection of trapped condensation and be devoid of traps. Slope underground raceways away from the building or provide weep holes when sloping away from the building is not possible.

F. Do not terminate in, or fasten raceways to, motor foundations.

G. Raceways installed outside underground shall have a minimum of twenty-four (24) inches top cover. Separate electric raceways from telephone (and other low voltage systems) raceways with a minimum of twelve (12) inches of well-tamped earth, or six (6) inches of concrete.

H. Joints in raceways in concrete or underground shall be watertight. Steel conduits shall have ends cut square. Ream smooth and paint male threads with graphite- base pipe compound and draw up tight with conduit couplings. Do not paint female threads; where required, use Erickson, or equal, conduit fittings. Running threads shall not be permitted. Place caps in ends of conduits as soon as located to prevent entry of foreign material. Screwed on caps shall be used for threaded conduits. Unused (abandoned) conduits shall be capped. The use of tape, paper or rag wads in not acceptable for conduit caps.

I. After conduit installation, clean and paint marred surfaces affecting galvanizing with asphaltum, galvanized-iron primer.

J. Run conduit above suspended ceilings for outlets in suspended ceilings. Keep clear of planned ductwork where turning down from slab into suspended ceiling.

K. Horizontal or cross runs in solid partitions and walls shall not be permitted.

L. Conduits designated on the Drawings as empty conduits (EC) shall have a properly sized pull-line.

M. Flexible metal conduit used for connection of luminaires (lighting fixtures), receptacles outlets, telepower poles, and as otherwise shown on the Drawings, shall be supported and bonded in accordance with NEC Article 348.

N. Conduit runs in concrete slabs shall be installed only where shown on the Drawings and shall be limited to 3/4-inch conduit.

O. Where embedded conduits cross building expansion joints, the Contractor shall furnish and install an offset expansion joint or a sliding expansion joint. Sliding expansion joints shall be provided with bonding strap and clamp. Where conduits are exposed, provide expansion fittings or flexible conduit as required.

P. In all wet and damp locations, boiler rooms, elevator machine rooms, kitchens, mechanical rooms, pump rooms, fire sprinkler service room, and all other similar spaces, all final electrical connections to any and all equipment, regardless of the type, shall consist of conductors run in polyvinyl sheathed flexible metal conduit ("Sealtite") with maximum lengths as hereinbefore specified.

Q. Conduits/raceways shall not be permitted to be run exposed on top of finished floors or grade, unless specifically shown on the drawings or approved by the Owner in advance.

R. Raceways or sleeves known to be subjected to different temperatures and where condensation is known to be a problem, as in cold storage areas of (or in) the building or where passing from the interior to the exterior of the building, the raceway or sleeve shall be filled with an approved material to prevent the circulation of warm air to a cold section of the raceway or sleeve, per NEC 300.7.

III. CABLE TRAY

A. Installation shall be in accordance with equipment manufacturer's instructions and with recognized industry practices (NEMA VE 2), to ensure that cable tray equipment complies with requirements of the NEC and applicable portions of NFPA 70B.

B. Cable tray shall be supported from the building structure. Supports attached to structural steel joists shall only be attached within 3" of the joist panel points, top or bottom. Supports attached beyond 3" of the joist panel points must be approved, in writing, by the Structural Engineer of record and the Owner before attaching.

C. Coordinate cable tray with other electrical work and other trades' work as necessary to properly integrate installation of cable tray work with other work.

D. Provide sufficient space encompassing cable trays to permit access for installing and maintaining cables.

E. Test cable trays to ensure electrical continuity of bonding and grounding connections and to demonstrate compliance with specified minimum grounding resistance. Refer to NFPA 70B, Chapter 18, for testing requirements and test methods.

IV. CABLE HOOK SUPPORT SYSTEM

A. Installation and configurations shall conform to the requirements of the current revision levels of ANSI/EIA/TIA Standards 568 & 569, NEC, the manufacturer's installation instructions and other sections of these project specifications.

B. Cable hook assemblies shall be supported from the building structure. Where fastened to walls use appropriate anchors and screws, the use of drive pins and/or other methods using compressed air or gases are not acceptable. Supports shall not terminate or be fastened directly to the roof decking Cables installed under roof decking shall not be less than 1½ inches from the nearest surface of the roof. Cable hook supports attached to structural steel joists shall only be attached within 3" of the joist

panel points, top or bottom. Supports attached beyond 3” of the joist panel points must be approved, in writing, by the Structural Engineer of record and the Owner before attaching.

C. Install cables using techniques, practices, and methods that are consistent with Category 5 cables or higher requirements and that support Category 5 or higher performance of completed and linked signal paths, end to end.

D. Install cables without damaging conductors, shield, or jacket.

E. Do not bend cables, in handling or in installing, to smaller radii than minimums recommended by cable manufacturers.

F. Do not exceed load ratings and allowable fill capacity specified by the cable hook manufacturer.

G. Install cable hooks to maintain a minimum three (3) inch clear or higher vertical space above the accessible ceiling tiles for the horizontal cabling and pathway.

V. CUTTING AND HOLES

A. Locate holes in advance where they are proposed in structural sections such as ribs or beams. Prior to drilling through any structural section or member, obtain the written approval of the Architect/Structural Engineer of Record and the Owner.

B. Cut holes through concrete and masonry structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted in advance by the Architect/Engineer and Owner, due to limited working space.

C. Openings in floor slabs or fire-rated walls or partitions for raceways and other electrical equipment shall, after installation of the raceway, be fire stopped using a product similar to THOMAS & BETTS "Flame-Safe" fire retardant.

VI. ROOFTOP CONDUIT SUPPORT STRUT SYSTEM

A. Rooftop conduit support struts shall be installed in accordance with manufacturer’s instructions and recommendations.

B. Determine that the structure, roof insulation, and roof membrane are structurally adequate to support weight of conduits (with conductors), supports and hangers.

C. Install supports at maximum spacing of 10 feet, unless closer spacing is required due to weight of conduits or as shown on the Drawings. Do not exceed manufacturer’s recommended load limits.

D. Support pads: Remove rock or gravel from area to be covered by pad, apply on clean area, and center bases on top of support pads.

E. Set conduit in support without dropping or causing undue impact. Install properly sized clamps to suit conduit sizes.

F. Always consult roofing manufacturer for roof membrane compression capacities. If necessary, a compatible sheet of roofing material (rubber pad) may be installed under rooftop support to disperse concentrated loads and add further membrane protection.

G. Contractor shall adjust conductor sizes in raceways in accordance with the National Electrical Code section 310.15(B)(2)(c) based on an average ambient temperature of 84°F.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include furnishing and installing surface mounted metal raceways complete for all electrical systems as shown on the Drawings and herein specified. Surface raceway systems shall consist of raceway bases, covers, appropriate fittings, dividers, and device mounting plates necessary for a complete installation.

III. QUALITY ASSURANCE

A. All equipment, materials, and their installation shall conform to the requirements of the National Electrical Code (NEC), local code requirements, and these Specifications.

B. All equipment and materials shall be listed by Underwriters Laboratories, Inc. (UL) for their intended use and shall bear the UL label.

C. Equipment shall be constructed in accordance with National Electrical Manufacturer's Association (NEMA) standards.

D. Submittals are required in accordance with SECTION 16010 of these Specifications.

IV. USES PERMITTED

A. Surface mounted metal raceway shall be used primarily where new wiring is required on existing walls and on new walls as noted on the Drawings.

B. Over floor metal raceways shall be used in dry locations where wiring is required over floors to provide electrical services under desks and similar spaces as shown on the Drawings.

V. DELIVERY, STORAGE AND HANDLING

A. Deliver raceway systems in factory labeled packages.

B. Store and handle in strict compliance with manufacturer’s written instructions and recommendations.

C. Protect from damage due to weather, excessive temperature, and construction operations.

Part 2 - Products

2.1 MANUFACTURERS

A. Surface metal raceways shall be as manufactured by THE WIREMOLD COMPANY or equal product as manufactured by HUBBELL INCORPORATED, as described herein as the basis of design.

B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with
texture and color selected by Architect from manufacturer's standard colors.

C. Surface Nonmetallic raceways shall be as manufactured by THE WIREMOLD COMPANY, Panduit Corp., or equal product as manufactured by HUBBELL INCORPORATED, as described herein as the basis of design.

D. All components and fittings shall be of the same manufacturer, or UL listed as an assembly.

2.2 MATERIALS AND COMPONENTS

A. All surface metal raceways shall be galvanized steel, with snap on covers unless otherwise indicated. Finish shall be ivory in color (unless otherwise indicated) having a scratch- resistant surface (a polyester topcoat over ivory base) and shall be suitable for field repainting to match surroundings.

B. A full complement of fittings must be available including but not limited to mounting clips and straps, couplings, flat, internal and external elbows, cover clips, tees, entrance fittings, wire clips, support clips, c-hangers, end caps, conduit connectors, bushings, and take-off fittings to adapt to flush wall boxes. The covers shall be painted with an enamel finish, ivory in color to match the raceway. They shall overlap the raceway to hide uneven cuts. All fittings shall be supplied with a base where applicable to eliminate mitering. Transition fittings shall be available to adapt to other raceways manufactured by The Wiremold Company. This Contractor shall provide all fittings, etc. for a complete installation.

C. Device Boxes shall be suitable for the type of raceways provided and for mounting standard devices and faceplates. Devices boxes shall be provided in single- and multiple-gang configurations, up to six-gang. Single-gang boxes shall allow for snap-on and fastener applications. They shall range in depth from 0.94” to 2.75”. Extension boxes shall be provided to adapt to existing standard flush switch and receptacle boxes.

D. The raceway manufacturer shall provide a complete line of connectivity outlets and modular inserts for UTP/STP, Fiber Optic, Coaxial and other cabling types with face

plates and bezels to facilitate mounting. A complete line of preprinted station and port

identification labels, snap-in icon buttons as well as write-on station identification labels shall be available. Provide as needed for a complete installation.

E. Raceways used for communications cabling shall have a complete line of full capacity corner elbows and tee fittings, and used where required or shown on the Drawings, to maintain a controlled 2” cable bend radius which meets the specifications for Fiber Optic and UTP/STP cabling and exceeds the TIA 569 requirements for communications pathways.

2.3 SURFACE METAL RACEWAYS

A. WIREMOLD Series V500 or V700 raceway shall be one-piece design with a base and cover factory assembled. The total width shall be 3/4” x 17/32” high with a capacity of 1.19 square inches for V500 or 3/4" x 21/32” with a capacity of 0.26 square inches for V700. The raceway base and cover shall be a minimum thickness of 0.040”. The raceway shall be available in five (5) foot and ten (10) foot lengths.

B. WIREMOLD Series V2400 raceway shall be a single-channel two-piece design with a metal base and snap-on metal cover. The assembled base and cover shall be 1 7/8” wide x 7/8” high with a capacity of 1.39 square inches. The raceway base and cover shall be a minimum thickness of 0.040”. The raceway base shall be available in ten (10) foot lengths and the cover shall be available in five (5) foot lengths.

C. WIREMOLD Series V3000 raceway shall be a single-channel two-piece design with a metal base and snap-on metal cover. The assembled base and cover shall be 2 3/4” wide x 1 17/32” high with a capacity of 3.70 square inches. The raceway base and cover shall be a minimum thickness of 0.040”. The raceway base shall be available in ten (10) foot lengths and the cover shall be available in five (5) foot lengths.

1. Device brackets shall be provided for mounting standard single or two- gang devices within the raceway.

D. WIREMOLD Series V4000 raceway shall be a single-or dual-channel two-piece design with a metal base and snap-on metal cover. Base shall be dividable by means of a removable barrier section into two equal compartments. The assembled base and cover shall be 4 3/4" wide x 1 3/4" high with a capacity of 7.20 square inches for undivided raceway and a capacity of 3.10 square inches for each compartment of the divided raceway. The raceway base shall be a minimum thickness of 0.050 inches and the cover with a minimum thickness of 0.040”. The raceway base shall be available in ten (10) foot lengths and the cover shall be available in five (5) foot lengths.

1. Plastic device mounting bracket and trim plates shall be provided to install devices horizontally within the raceway. Trim plate shall overlap the cover-eliminating seam. Faceplates shall accept a variety of power and data/communication devices. Plastic must be compatible with UL 94 for Plastic Materials. Device brackets and trim plates shall be colored to match the raceway.

E. WIREMOLD Series S4000 raceway shall be a dual-channel two-piece design with a Type 302 stainless steel base and snap-on cover having a Number 4 brushed finish. Base shall be dividable by means of a removable barrier section into two equal compartments. The assembled base and cover shall be 4 ¾" wide x 1 ¾" high with a capacity of 7.20 square inches for each compartment of the divided raceway. The raceway base shall be a minimum thickness of 0.050 inches and the cover with a minimum thickness of 0.040". The raceway base shall be available in ten (10) foot lengths and the cover shall be available in five (5) foot lengths.

1. Plastic device mounting bracket and trim plates shall be provided to install devices horizontally within the raceway. Trim plate shall overlap the cover-eliminating seam. Faceplates shall accept a variety of power and data/communication devices. Plastic must be compatible with UL 94 for Plastic Materials. Device brackets and trim plates shall be colored to match the raceway.

F. WIREMOLD Series V6000 raceway shall be a single-or dual-channel two-piece design with a metal base and snap-on metal cover. Base shall be dividable by means of a removable barrier section into two equal compartments. The assembled base and cover shall be 4 3/4" wide x 3 9/16" high with a capacity of 16.00 square inches for undivided raceway and a capacity of 7.20 square inches for each compartment of the divided raceway. The raceway base shall be a minimum thickness of 0.050 inches and the cover with a minimum thickness of 0.040". The raceway base shall be available in ten (10) foot lengths and the cover shall be available in five (5) foot lengths.

1. Plastic device mounting bracket and trim plates shall be provided to install devices horizontally within the raceway. Trim plate shall overlap the cover-eliminating seam. Faceplates shall be available to accept a variety of power and data/communication devices. Plastic must be compatible with UL 94 for Plastic Materials. Device brackets and trim plates shall be colored to match the raceway.

G. WIREMOLD Series OFR (OVERFLOOR RACEWAY). Over floor raceway shall be low profile ADA compliant, multi-piece design with aluminum base and screw- on steel covers. The assembled base and cover shall be 7" wide x 1/2" high. Height of assembled base and cover increases from 0" at edge to 1/2" with a slope of no less than 1:2. Base shall have four (4) wiring channels, separated by three (3) integral dividers. The raceway base shall be aluminum with a minimum thickness of 0.080 inches and the cover shall be steel with a minimum thickness of 0.040 inches. Bases for raceway and device boxes shall be suitable for mounting directly to bare concrete or floor coverings. The raceway base and covers shall be available in eight (8) foot lengths.

1. Covers, fittings, device boxes, etc. for the OFR shall have a durable black powder coat finish.

2. Over floor raceway 2-or 4-gang divided device boxes shall allow for multiple

services (power, communications, A/V) at a single point-of-use with side facing device mounting. The assembled device box shall be 7” wide x 2 1/4” high x 13” long (2-gang) or 18” long (4-gang). This low-profile device box shall allow space for large cable bend radius and accept OFR Series device plates. Removable divider can be aligned with any of the raceway channels.

3. Provide all fittings, crossovers, clips, raceway transitions to other vertical raceway types, device plates, etc. necessary for a complete OFR system.

Part 3 - Execution

I. EXAMINATION

A. Examine conditions under which surface raceways, boxes, distribution systems, accessories, and fittings are to be installed and substrate that will support raceways. Notify the Architect/Engineer and Owner of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected.

II. INSTALLATION

A. Surface raceways shall be installed in strict compliance with the manufacturer’s installation instructions and recommendations and approved shop drawings. Coordinate installation with adjacent work to ensure proper clearances and to prevent electrical hazards.

B. Surface raceways shall be installed parallel with or at right angles to building structure and at the mounting heights noted on Drawings.

C. Surface raceway systems shall be mechanically continuous and connected to all electrical outlets, boxes, device mounting brackets, and cabinets, in accordance with manufacturer’s installation sheets.

D. Metal raceways shall be electrically continuous and bonded in accordance with the National Electrical Code for proper grounding.

E. Surface raceway shall be supported at intervals not exceeding five (5) feet or in accordance with manufacturer’s installation sheets using appropriate anchors and screws. The use of drive pins and/or other methods using compressed air or gases are not acceptable.

1. V500 and V700 shall be supported using two (2) hole straps specifically designed for the application secured with plastic anchors and No. 6 screws.

F. Provide accessories as required for a complete installation, including insulated bushings and inserts where required by the manufacturer.

G. Close all unused raceway openings using manufacturer’s recommended accessories.

H. All surface raceway connections to outlet and/or junction boxes shall be made using

adjustable offset connectors or combination connectors as detailed on the Drawings. The connectors shall be furnished by the manufacturer of the surface raceway.

I. Field cutting of surface raceways base and covers shall be accomplished by the use of the manufacturer's raceway cutters specifically designed for this purpose.

III. CLEANING AND PROTECTION

A. Clean exposed surfaces using non-abrasive materials and methods recommended by manufacturer.

B. Protect raceways and boxes until final acceptance by the Owner.

C. Repaint marred and scratched surfaces with touch-up paint to match original finish.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include furnishing and installing Cabinets, enclosures and junction and pull boxes larger than 100 cubic inches complete for all electrical systems as shown on the Drawings and herein specified,

III. QUALITY ASSURANCE

A. All equipment, material, and their installation shall conform to the requirements of the National Electrical Code (NEC), local code requirements, and these Specifications.

B. All equipment and materials shall be listed by Underwriters Laboratories, Inc. (UL) for their intended use and shall bear the UL label.

C. Equipment shall be constructed in accordance with National Electrical Manufacturer's Association (NEMA) standards.

D. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

F. Submittals are required in accordance with SECTION 16010 of these specifications.

IV. DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer instructions.

Part 2 - Products

II. BOXES ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.

2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman.
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.
7. RACO; a Hubbell Company.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet Division.
10. Spring City Electrical Manufacturing Company
11. Thomas & Betts Corporation.
12. Wiremold Wire & Cable Management ; Legrand
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.

D. Metal Floor Boxes: Cast metal, fully adjustable, rectangular.

E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

F. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.

G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic.

H. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.

3. Key latch to match panelboards.

4. Metal barriers to separate wiring of different systems and voltage.

5. Accessory feet where required for freestanding equipment.

III. MATERIALS AND COMPONENTS

A. Junction and pull boxes shall be provided where indicated and required and shall be of the type and size for the installation of the electrical system. Junction or pull boxes not over one hundred (100) cubic inches in volume shall be constructed in accordance with the requirements of NEC. All junction boxes shall have removable screwed covers and be accessible after completion of the building. Removable covers shall not exceed three (3) feet in size in any direction and split covers shall be used for boxes larger than three (3) feet in any direction. Where several feeders pass through a common pull box, the feeders shall be tagged to indicate clearly their electrical characteristics and branch circuit numbers and panelboard designation. This same information shall be stenciled in paint on the cover of each box.

1. Pull and junction boxes shall be made of code gauge galvanized sheet steel with removable screw covers. Minimum size shall be 4 inch x 4 inch x 2-1/8 inches deep.

2. Cast metal pull boxes shall be provided in damp or wet locations, with a gasketed screwed cover, and drilled and tapped holes as required. Screws shall be brass or bronze.

3. Pull boxes shall be provided in any conduit run which exceeds one hundred (100) feet in length, or any run having more than two hundred seventy (270) total degrees of bend.

IV. UNDERGROUND BOXES AND ENCLOSURES

A. Underground boxes, enclosures and covers shall conform to all test provisions of the most current ANSI/SCTE 77 “Specifications for Underground Enclosure Integrity” for Tier 15 applications. When multiple tiers are specified the boxes must physically accommodate and structurally support compatible covers while possessing the highest Tier rating. In no assembly can the cover design load exceed the design load of the box. All components in an assembly (box and cover) shall be manufactured using matched surface tooling. All covers are required to have a minimum coefficient of friction of 0.05 in accordance with ASTM C1028 and the corresponding Tier level embossed on the top surface. Assemblies not U.L. Listed shall have independent third party verification or test reports stamped by a registered Professional Engineer certifying that all test provisions of this specification have been met are required with each submittal.

1. Color of Frame and Cover: Gray.

2. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.

3. Cover: Weatherproof, secured by tamper-resistant locking devices and having

structural load rating consistent with enclosure.

4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

5. Cover Legend: Molded lettering, "ELECTRIC." And “EMERGENCY”

6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

B. Underground boxes, enclosures and covers shall be as manufactured by QUAZITE or approved equal.

1. Telephone Service inground enclosure box and cover shall be QUAZITE Cat. No. PG3048BA36 box with Cat. No. PG3048HS0043 cover.

2. CATV Service inground enclosure box and cover shall be QUAZITE Cat. No. PG3048BA36 box with Cat. No. PG3048HS0010 cover.

3. Sports Field Lighting Pole ground rod hand hole enclosure box and cover shall be QUAZITE Cat. No. PG1118BA18 box with Cat. No. PG1118CA0024 cover.

4. Other applications requiring the use of exterior underground boxes or enclosures shall use QUATIZE “PG” Series enclosure boxes appropriately sized complete with the proper cover with logo designating the use of the box or enclosure.

C. Fiberglass Handholes and Boxes with Polymer-Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester-resin enclosure joined to polymer-concrete top ring or frame.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a) Armorcast Products Company.

b) Carson Industries LLC.

c) Christy Concrete Products.

d) Synertech Moulded Products, Inc.; a division of Oldcastle Precast.

Part 3 - Execution

I. EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

II. INSTALLATION

A. Install products in accordance with manufacturer's instructions.

1. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

2. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

3. Provide separate boxes for emergency power and normal power systems.

4. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

a) Pull and junction boxes shall be installed where indicated on the Drawings or as herein specified. Boxes shall be located so as to be inaccessible to the general public.

b) All boxes and conductors therein shall be marked as hereinbefore specified to indicate the voltage and circuit numbers.

c) Boxes shall not be fastened in place with drive pins and/or other methods using compressed air or gases.

d) Boxes located under roof decking shall not be less than 1½ inches from the nearest surface of the roof decking.

e) Pull and junction boxes shall be concealed except in electrical and mechanical equipment rooms, spaces architecturally designed to have an open structure without ceilings or as otherwise indicated on the Drawings.

f) All system pull and junction box covers shall be painted as follows:

(1) 120/208 Volt - Black

(2) 277/480 Volt - Orange

(3) Clocks and Program Clocks - Green

(4) Emergency - White

(5) Fire Alarm - Red

(6) Security System - Gray

(7) Sound - Blue

(8) Telecommunications - Yellow

(9) Cable Television/Broadband - Tan

(10) Verizon Communications I-NET (fiber) - Purple

III. UNDERGROUND BOXES AND ENCLOSURES

A. Exterior underground boxes and enclosures shall be installed per manufacturer's recommendations and the following minimum requirements:

1. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

2. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

3. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

4. Install handholes and boxes with bottom below the frost line, 36" below grade.

5. After the proper location of the underground enclosure has been established and the conduits, underground cables or ground rods, etc. are installed or located, the hole for the enclosure shall be excavated and shall be at least six (6) to eight (8) inches deeper that the depth of the enclosure and shall have a minimum of six (6) inches of gravel in the bottom of the hole or as shown on the Drawings. The gravel base shall extend past the side walls of the enclosure by at least four (4) to six (6) inches. Once the enclosure is positioned on top of the gravel base and the elevation check, the enclosure shall be back-filled.

6. Back-filling shall have 95% compaction or greater.

7. Provide internal bracing during back-filling to ensure minimal box sidewall deflections. Bracing supports shall be 2x4's or similar material sized to hold the box at mid-depth.

8. Top of the box and cover shall be flush with the finished grade.

IV. CONDUCTORS

A. All conductors entering junction and pull boxes shall be of the same voltage. Do not mix voltages regardless of the conductors' voltage rating, unless specifically shown on the Drawings.

B. Branch circuit conductors and feeder conductors shall not occupy the same junction or

pull box. Maintain separate boxes for branch circuits and separate boxes for feeders, unless specifically shown otherwise on the drawings.

V. ARC-PROOFING

A. All feeders entering a pull box containing more than one (1) feeder, or more than one (1) parallel feeder, shall be arc-proofed as follows. Conductors of the same feeder, including each set of a parallel feeder, shall be tightly grouped together and held in place with random wrapped 3M No. 33 Tape. Grouped cables shall be arc proofed using spirally wound one half-lapped layer of 3M No. 77 Fire and Arc-Proofed Tape which shall be held in place with random wrapped 3M No. 69 Glass Cloth Electrical Tape.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include
1. Furnishing and installing device and outlet boxes,

2. Flush floor outlets (boxes), Floor box service fittings. Poke-through assemblies. and Science Room multiplex service fittings complete for all electrical systems as shown on the Drawings and herein specified.

3.2 QUALITY ASSURANCE

A. All equipment, materials, and their installation shall conform to the requirements of the National Electrical Code (NEC), local code requirements, and these Specifications.

B. All equipment and materials shall be listed by Underwriters Laboratories, Inc. (UL) for their intended use and shall bear the UL label.

C. Equipment shall be constructed in accordance with National Electrical Manufacturer's Association (NEMA) standards.

D. Flush floor outlet boxes and/or poke-thru devices shall have been tested to meet UL514A and/or UL514C and bear the UL Listing Mark. Floor boxes/devices shall be classified for use in 2-hour rated unprotected reinforced concrete floors and concrete toppings (D900 Series Designs) or above grade concrete floors with suspended ceilings (fire resistive designs with suspended ceilings shall have provisions for accessibility in the ceiling below the floor boxes/devices). Floor boxes/devices shall also conform to the standards set in Section 300.21 of the National Electrical Code. Floor Boxes/devices shall meet UL scrub water requirements, but are not suitable for wet or damp locations, or other areas subject to saturation with water or other liquids such as commercial kitchens. Floor boxes/devices shall also have been evaluated by UL to meet the applicable
U.S. safety standards for scrub water exclusion when used on tile, bare concrete, terrazzo, wood, and carpet covered floors. Above grade floor boxes/devices shall be suitable for use in air handling spacers in accordance with Section 300.22 (C) of the National Electrical Code.

E. Submittals are required in accordance with SECTION 16010 of these specifications.

Part 2 - Products

I. MATERIALS AND COMPONENTS

A. Boxes shall be steel, hot-dipped galvanized after fabrication, of the type and size for the intended use, and shall have only the holes necessary to accommodate the conduits at point of installation. Multi-gang boxes shall be used for multiple device locations utilizing a single multi-gang cover plate. Sectionalized boxes are not permitted. Boxes shall have barrier separations for conductors using different voltages within the same box.

B. Outlet boxes for lighting switches and receptacles in finished walls shall be of a suitable size for the device to be mounted in the partitions in which they are installed. The boxes shall have covers with rectangular openings of appropriate size and shape. Provide covers with raised openings on all outlets in masonry walls with plaster or tile finishes. Wall switch outlets shall be located within eight (8) inches of the trim on the latch side of the door. Outlets shall be set flush with the wall.

C. Single gang outlet boxes installed in concrete, masonry or gypsum wall board shall be a minimum four (4) inches square, 1-1/2 inches deep with appropriate tile ring, set flush with wall surface and provided with a single gang cover plate.

D. Outlet boxes for exposed lighting switches and receptacles shall be of the cast "FS" type or “FD” type (when required for code required box volume).

E. Outlet boxes for devices shown on the Drawings to be flush mounted in existing gypsum wallboard partitions shall be minimum three (3) inches by two (2) inches by 2-3/4 inches deep gangable switch box type complete with ears and conduit knockouts.

II. MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Legrand North America, LLC (Wiremold)

III. FLUSH FLOOR OUTLETS

A. Flush floor outlets designated on the Drawings as “Type A” shall consist of a WIREMOLD Model No. EFB6S-OG floor box or approved equal manufactured from stamp steel approved for use with on-grade concrete floor applications. Boxes shall have the ability to accept a component (EFB610-CTR) that will allow the box to be installed flush in polished concrete or terrazzo floors. Boxes shall be painted with a fusion-bonded epoxy designed for use on metal reinforcement bar and related accessories before encapsulation in concrete, and be approved for use on-grade and above grade floors. Boxes shall be 15-3/16” L x 13-7/8” W x 4- 3/16” H [385mm x 351mm x 107mm]. Provide boxes with six (6) independent wiring compartments that allow for up to six (6) duplex receptacles, communication and/or audio/video services. Boxes shall have removable and relocatable dividers to permit custom configuration of compartments as well as permit feed to

adjacent compartments. Boxes shall permit feed to compartments on the opposite side of the box through a tunnel. Each of the four (4) outer compartments shall have a minimum wiring capacity of 32-in^3 [524ml]. Each of the two (2) center compartments shall have a minimum wiring capacity of 38.5- in^3 [630ml]. Each of the six (6) compartments shall have a minimum depth of 3- 7/8" [98mm] behind the plate. Provide boxes with removable compartments to facilitate installation. The compartments shall be removable from the top of the floor box. Provide boxes with two (2) cable guides to organize and maintain the cables egress out of the box. The box shall contain the following number of knockouts: 10 1" trade size, six (6) 1-1/4" trade size, and six (6) 3/4" trade size. Boxes shall be fully adjustable, accommodating a maximum 2-inch [51mm] pre- concrete pour and a maximum 1/2" [12.7mm] post-concrete pour adjustment. The box shall be able to accept 2-3/4" x 4-1/2" standard size wall plates. Include mounting brackets with the boxes that will accommodate 15 amp, 20-amp straight blade, 20 amp turn loc, 30-amp straight blade and 30 amp turn loc receptacles, Ortronics® workstation connectivity and modular adapters, a variety of audio/video devices from most manufacturers, and other open system devices.

1. This floor box shall contain three (3) two pole, three wire, 20 amp, 125 volt, NEMA 5-20R duplex receptacles as hereinbefore specified complete with cover plates; one (1) two (2) port modular jack kit complete with one RJ-45 (568A) voice port and one (1) RJ-45 (568A) data port; and two blank single gang cover plates.

2. Floor boxes shall be complete with die-cast aluminum Activation Covers. Activation covers shall be available in surface mount and flush versions. Provide covers with two (2) gaskets (one (1) for carpet and one (1) for tile) to go under the trim flange to maintain scrub water tightness. Covers shall be 16-15/16" x 12-1/2" x 3/16" [430mm x 318mm x 4mm]. Covers shall be provided with a carpet recess area in carpeted and tiled areas or a solid lid in non-carpeted/tiled areas. Secure the cover to the flange and enable cover to rotate greater than 180 degrees to reduce trip hazards and provide maximum amount of working space. Provide covers with spring-loaded self-closing slide egress doors to reduce egress opening when cables are exiting and reduce trip hazards. Each of the two (2) egress openings shall have a minimum of 4-in^2 [102mm^2], or a minimum of 8-in^2 [203mm^2] per cover assembly. Covers shall have a powder coat finish with one of the following colors to be selected by the architect.

B. Flush floor outlets designated on the Drawings as "Type B" shall consist of a WIREMOLD Model No. EFB6S-OG floor box or approved equal manufactured from stamp steel approved for use with on-grade concrete floor applications. Boxes shall have the ability to accept a component (EFB610-CTR) that will allow the box to be installed flush in polished concrete or terrazzo floors. Boxes shall be painted with a fusion-bonded epoxy designed for use on metal reinforcement bar and related accessories before encapsulation in concrete, and be approved for use on-grade and above grade floors. Boxes shall be 15-3/16" L x 13-7/8" W x 4- 3/16" H [385mm x 351mm x 107mm]. Provide boxes with six (6) independent wiring compartments that allow for up to six (6) duplex receptacles, communication and/or audio/video services. Boxes shall have removable and relocatable dividers to permit custom configuration of compartments as well as permit feed to

adjacent compartments. Boxes shall permit feed to compartments on the opposite side of the box through a tunnel. Each of the four (4) outer compartments shall have a minimum wiring capacity of 32-in^3 [524ml]. Each of the two (2) center compartments shall have a minimum wiring capacity of 38.5- in^3 [630ml]. Each of the six (6) compartments shall have a minimum depth of 3- 7/8" [98mm] behind the plate. Provide boxes with removable compartments to facilitate installation. The compartments shall be removable from the top of the floor box. Provide boxes with two (2) cable guides to organize and maintain the cables egress out of the box. The box shall contain the following number of knockouts: 10 1" trade size, six (6) 1-1/4" trade size, and six (6) 3/4" trade size. Boxes shall be fully adjustable, accommodating a maximum 2-inch [51mm] pre- concrete pour and a maximum 1/2" [12.7mm] post-concrete pour adjustment. The box shall be able to accept 2-3/4" x 4-1/2" standard size wall plates. Include mounting brackets with the boxes that will accommodate 15 amp, 20-amp straight blade, 20 amp turn loc, 30-amp straight blade and 30 amp turn loc receptacles, Ortronics® workstation connectivity and modular adapters, a variety of audio/video devices from most manufacturers, and other open system devices.

1. This floor box shall contain three (3) two pole, three wire, 20 amp, 125 volt, NEMA 5-20R duplex receptacles as hereinbefore specified complete with cover plates; and four (4) two port modular jack kits complete with two (2) RJ-45 (568A) ports in each, for a total of eight (8) ports.

2. Floor boxes shall be complete with die-cast aluminum Activation Covers. Activation covers shall be available in surface mount and flush versions. Provide covers with two (2) gaskets (one (1) for carpet and one (1) for tile) to go under the trim flange to maintain scrub water tightness. Covers shall be 16-15/16" x 12-1/2" x 3/16" [430mm x 318mm x 4mm]. Covers shall be provided with a carpet recess area in carpeted and tiled areas or a solid lid in non-carpeted/tiled areas. Secure the cover to the flange and enable cover to rotate greater than 180 degrees to reduce trip hazards and provide maximum amount of working space. Provide covers with spring-loaded self-closing slide egress doors to reduce egress opening when cables are exiting and reduce trip hazards. Each of the two (2) egress openings shall have a minimum of 4-in^2 [102mm^2], or a minimum of 8-in^2 [203mm^2] per cover assembly. Covers shall have a powder coat finish with one of the following colors to be selected by the architect.

C. Flush floor outlets designated on the Drawings as "Type C" shall consist of a WIREMOLD Model No. EFB6S-OG floor box or approved equal manufactured from stamp steel approved for use with on-grade concrete floor applications. Boxes shall have the ability to accept a component (EFB610-CTR) that will allow the box to be installed in polished concrete or terrazzo floors. Boxes shall be painted with a fusion-bonded epoxy designed for use on metal reinforcement bar and related accessories before encapsulation in concrete, and be approved for use on-grade and above grade floors. Boxes shall be 15-3/16" L x 13-7/8" W x 4-3/16" H [385mm x 351mm x 107mm]. Provide boxes with six (6) independent wiring compartments that allow for up to six (6) duplex receptacles, communication and/or audio/video services. Boxes shall have removable and relocatable dividers to permit custom configuration of compartments as well as permit feed to adjacent compartments. Boxes shall permit feed to compartments on the opposite side of

the box through a tunnel. Each of the four (4) outer compartments shall have a minimum wiring capacity of 32-in^3 [524ml]. Each of the two (2) center compartments shall have a minimum wiring capacity of 38.5- in^3 [630ml]. Each of the six (6) compartments shall have a minimum depth of 3- 7/8" [98mm] behind the plate. Provide boxes with removable compartments to facilitate installation. The compartments shall be removable from the top of the floor box. Provide boxes with two (2) cable guides to organize and maintain the cables egress out of the box. The box shall contain the following number of knockouts: 10 1" trade size, six (6) 1-1/4" trade size, and six (6) 3/4" trade size. Boxes shall be fully adjustable, accommodating a maximum 2-inch [51mm] pre- concrete pour and a maximum 1/2" [12.7mm] post-concrete pour adjustment. The box shall be able to accept 2-3/4" x 4-1/2" standard size wall plates. Include mounting brackets with the boxes that will accommodate 15 amp, 20-amp straight blade, 20 amp turn loc, 30-amp straight blade and 30 amp turn loc receptacles, Ortronics® workstation connectivity and modular adapters, a variety of audio/video devices from most manufacturers, and other open system devices.

1. This floor box shall contain with three (3) two pole, three wire, 20 amp,125 volt, NEMA 5-20R duplex receptacles as hereinbefore specified complete with cover plates; one (1) three port modular jack kit complete with two (2) RJ-45 (568A) ports and one (1) F-Connector; and one (1) RAPIDRUN Part No. 2212-42320-001 cover plate multi-media system outlet consisting of a double brushed aluminum faceplate with female HD15, 3.5mm audio, and RCA composite video and audio connectors; and one (1) blank single gang cover plate.

2. Floor boxes shall be complete with die-cast aluminum Activation Covers. Activation covers shall be available in surface mount and flush versions. Provide covers with two (2) gaskets (one (1) for carpet and one (1) for tile) to go under the trim flange to maintain scrub watertightness. Covers shall be 16-15/16" x 12-1/2" x 3/16" [430mm x 318mm x 4mm]. Covers shall be provided with a carpet recess area in carpeted and tiled areas or a solid lid in non-carpeted/tiled areas. Secure the cover to the flange and enable cover to rotate greater than 180 degrees to reduce trip hazards and provide maximum amount of working space. Provide covers with spring-loaded self-closing slide egress doors to reduce egress opening when cables are exiting and reduce trip hazards. Each of the two (2) egress openings shall have a minimum of 4-in^2 [102mm^2], or a minimum of 8-in^2 [203mm^2] per cover assembly. Covers shall have a powder coat finish with one of the following colors to be selected by the architect.

D. Flush floor outlets designated on the Drawings as Type "D" shall be THOMAS & BETTS (STEEL CITY) Cat. No. 643, 3-gang case iron floor box complete with three (3) separate wiring compartments; cast iron watertight body, one (1) P64DS duplex brass mop tight cover plate, two (2) P64-GFCI brass mop tight cover plates, one (1) OPODEC-XLRF-WH rectangular microphone jack adaptor, one (1) OPODEC1-WH device plate with keystone port with one (1) ORTRONICS Cat. No. OR-KS35STST 3.5mm keystone adaptor. The body shall be divided having one (1) NEMA 5-20R duplex receptacle as previously specified, one (1) microphone jack and one (1) 3.5mm jack for MP3. The trim, shall be completely flush with the finished floor.

E. Flush floor outlets designated on the Drawings as “Type E” shall be THOMAS & BETTS (STEEL CITY) Cat. No. 642, 2-gang cast iron floor box complete two (2) P64DS duplex brass mop tight cover plates, two (2) NEMA 5-20R duplex receptacles as previously specified. The trim, shall be completely flush with the finished floor. Each floor outlet shall be complete with carpet flange assembly in carpeted areas; and non-skid top in non-carpeted areas.

F. Flush floor outlets designated on the Drawings as “Type F” shall be WIREMOLD Cat. No. 6ATCP fire-rated Poke-Thru Assembly Unit, for use in existing concrete floors, or approved equal. This assembly consists of an insert and an activation cover. Overall poke-thru assembly length shall be 16 3/4”. The insert body shall recess the devices a minimum of 2 3/4” and have a polyester based backing enamel finished interior (ivory). There shall be necessary channels to provide complete separation of power and communication services. There shall be three (3) compartments that allow for up to three (3) duplex receptacles and/or twelve (12) communications ports and/or ten (10) of Extron® Electronics MAAP™ and/or two (2) AAP™ devices. The body shall consist of an intumescent fire stop material to maintain the fire rating of the floor slab. The intumescent material will be held securely in place in the insert body and shall not have to be adjusted to maintain fire rating of the unit and the floor slab. The insert shall have retaining feature that will hold the poke-thru device in the floor slab without additional fasteners. The poke-thru insert shall also consist of a 3/4” trade size conduit stub that is connected to the insert body and a 24.5 cubic inch stamped steel junction box for wire splices and connections. The stamped steel junction box shall also contain the necessary means to electrically ground the poke-thru device to the system ground. Communication Modules Mounting Accessories: The poke-thru manufacturer shall have available open modular inserts to facilitate mounting UTP (including Category 5, 5e, 6), STP, fiber optic, coaxial, and data/communications devices. The activation shall have three (3) locations to mount communication connectors. Connectors shall be mounted using a mounting bracket. Where indicated, provide connectivity outlets and modular inserts by Ortronics or approved equal.

1. This floor box shall contain two (2) proprietary two pole, three wire, 20 amp, 125 volt, NEMA 5-20R duplex receptacles with mounting plates; one (1) ‘6TRAC’ device mounting plate for use in the center compartment only, complete with one (1) RJ-45 (568A) TracJack voice device and one RJ-45 (568A) TracJack data device; and four (4) blank TracJack inserts.

2. Flush Floor Poke-Thru shall be complete with die-cast aluminum Activation Covers. Two gaskets (one for carpet and one for tile) shall be provided to go under the trim flange to maintain scrub water tightness. The activation cover shall be 7 1/4” in diameter. The activation covers shall be available in carpet and tile versions. The carpet covers shall be surface mounted and the tile covers shall be flush with the finished floor coverings. The cover shall have spring loaded slides to allow cables to egress out of the unit and maintain as small an egress opening as possible. Covers shall have a powder coat finish with one of the following colors to be selected by the architect.

G. Flush floor outlets designated on the Drawings as “Type G” shall be WIREMOLD Cat. No. 8ATC fire-rated Poke-Thru Assembly Unit, for use in existing concrete floors, or approved equal. This assembly consists of an insert and an activation cover. Overall poke-thru

assembly length shall be 16 3/4". The INSERT body shall recess the devices a minimum of 2 3/4" and have a polyester based backing enamel finished interior (ivory). There shall be necessary channels to provide complete separation of power and communication services. There shall be five (5) compartments that allow for up to five (5) duplex receptacles and/or twenty-two (22) communications ports and/or sixteen (16) of Extron® Electronics MAAP™ and/or four (4) AAP™ devices. The body shall consist of an intumescent fire stop material to maintain the fire rating of the floor slab. The intumescent material will be held securely in place in the insert body and shall not have to be adjusted to maintain fire rating of the unit and the floor slab. The insert shall have retaining feature that will hold the poke-thru device in the floor slab without additional fasteners. The poke-thru insert shall also consist of a 3/4" trade size conduit stub that is connected to the insert body and a 24.5 cubic inch stamped steel junction box for wire splices and connections. The stamped steel junction box shall also contain the necessary means to electrically ground the poke-thru device to the system ground. Communication Modules Mounting Accessories: The poke-thru manufacturer shall have available open modular inserts to facilitate mounting UTP (including Category 5, 5e, 6), STP, fiber optic, coaxial, and data/communications devices. Where indicated, provide connectivity outlets and modular inserts by Ortronics or approved equal.

1. This floor box shall contain two (2) proprietary two pole, three wire, 20 amp, 125 volt, NEMA 5-20R duplex receptacles with mounting plates; one (1) duplex mounting plate (8DP) with one (1) two pole, three wire, 20 amp, 125 volt, NEMA 5-20R duplex receptacle to be used in the center compartment; one '8TRAC' device mounting plate for use in the center compartment only, complete with eight (8) RJ-45 (568A) TracJack devices; and one (1) blank (8B) device mounting plate to blank off one of the three gangs in the center compartment.

2. Flush Floor Poke-Thru shall be complete with die-cast aluminum Activation Covers. Two gaskets (one for carpet and one for tile) shall be provided to go under the trim flange to maintain scrub water tightness. The activation cover shall be 7 1/4" in diameter. The activation covers shall be available in carpet and tile versions. The carpet covers shall be surface mounted and the tile covers shall be flush with the finished floor coverings. The cover shall have spring loaded slides to allow cables to egress out of the unit and maintain as small an egress opening as possible. Covers shall have a powder coat finish with one of the following colors to be selected by the architect.

H. Flush floor outlets designated on the Drawings as "Type H" shall consist of a WIREMOLD Model EFB6S Floor Box or approved equal suitable for use in above grade applications in newly poured concrete floors or raised floors. The floor box shall be manufactured from stamped steel. Boxes shall have the ability to accept a component (EFB610-CTR) that will allow the box to be installed in polished concrete or terrazzo floors. Boxes shall have a polyester based backed enamel finished interior (white). Boxes shall be 15-3/16" L x 13-7/8" W x 4-3/16" H [385mm x 351mm x 107mm]. Provide boxes with provisions that enable installation into concrete floors, raised floors or wood floors without having to purchase additional components or accessories. Provide boxes with six (6) independent wiring compartments that allow for up to six (6) receptacles, communication and/or audio/video services. Boxes shall permit feed to adjacent compartments. Boxes shall have removable and relocatable dividers to permit custom configuration of compartments as well as permit feed to adjacent compartments. Boxes shall permit feed to compartments on the opposite side of the box through a tunnel. Each of the four (4) outer

compartments shall have a minimum wiring capacity of 32-in^3 [524ml]. Each of the two (2) center compartments shall have a minimum wiring capacity of 38.5-in^3 [630ml]. Each of the six (6) compartments shall have a minimum depth of 3-7/8" [98mm] behind the plate. Provide boxes with removable compartments to facilitate installation and moves, additions, and changes. The compartments shall be removable from the top and back of the floor box. Provide boxes with two (2) cable guides to organize and maintain the cables egress out of the box. Provide boxes with removable knockout plates to allow for the maximum cable pass-through area. The cable pass-through shall be a minimum of 6-16/16 in^2 [176mm^2]. The box shall contain the following number of knockouts: ten (10) 1" trade six, six (6) 1-1/4" trade size, six (6) 3/4" trade size, and two (2) 2" trade size. Boxes shall be fully adjustable, accommodating a maximum 2-inch [51mm] pre-concrete pour and a maximum 1/2" [12.7mm] post-concrete pour adjustment. The box shall be able to accept 2-3/4" x 4-1/2" standard size wall plates. Include mounting brackets with the boxes that will accommodate 15 amp, 20-amp straight blade, 20 amp turn loc, 30-amp straight blade and 30 amp turn loc receptacles, Ortronics® workstation connectivity and modular adapters, a variety of audio/video devices from most manufacturers, and other open system devices.

1. This floor box shall contain three (3) two pole, three wire, 20 amp, 125 volt, NEMA 5-20R duplex receptacles as hereinbefore specified complete with cover plates; one (1) two port modular jack kit complete with one (1) RJ-45 (568A) voice device and one (1) RJ-45 (568A) TracJack data device; and two (2) blank single gang cover plates.

2. Floor boxes shall be complete with die-cast aluminum Activation Covers. Activation covers shall be available in surface mount and flush versions. Provide covers with two (2) gaskets (one (1) for carpet and one (1) for tile) to go under the trim flange to maintain scrub water tightness. Covers shall be 16-15/16" x 12-1/2" x 3/16" [430mm x 318mm x 4mm]. Covers shall be provided with a carpet recess area in carpeted and tiled areas or a solid lid in non-carpeted/tiled areas. Secure the cover to the flange and enable cover to rotate greater than 180 degrees to reduce trip hazards and provide maximum amount of working space. Provide covers with spring-loaded self-closing slide egress doors to reduce egress opening when cables are exiting and reduce trip hazards. Each of the two (2) egress openings shall have a minimum of 4-in^2 [102mm^2], or a minimum of 8-in^2 [203mm^2] per cover assembly. Covers shall have a powder coat finish with one of the following colors to be selected by the architect.

I. Flush floor outlets designated on the Drawings as "Type J" shall consist of a WIREMOLD Model EFB6S Floor Box suitable for use in above grade applications in newly poured concrete floors or raised floors. The floor box shall be manufactured from stamped steel. Boxes shall have the ability to accept a component (EFB610-CTR) that will allow the box to be installed in polished concrete or terrazzo floors. Boxes shall have a polyester based backed enamel finished interior (white). Boxes shall be 15-3/16" L x 13-7/8" W x 4-3/16" H [385mm x 351mm x 107mm]. Provide boxes with provisions that enable installation into concrete floors, raised floors or wood floors without having to purchase additional components or accessories. Provide boxes with six (6) independent wiring compartments that allow for up to six (6) receptacles, communication and/or audio/video

services. Boxes shall permit feed to adjacent compartments. Boxes shall have removable and relocatable dividers to permit custom configuration of compartments as well as permit feed to adjacent compartments. Boxes shall permit feed to compartments on the opposite side of the box through a tunnel. Each of the four (4) outer compartments shall have a minimum wiring capacity of 32-in^3 [524ml]. Each of the two (2) center compartments shall have a minimum wiring capacity of 38.5-in^3 [630ml]. Each of the six (6) compartments shall have a minimum depth of 3-7/8" [98mm] behind the plate. Provide boxes with removable compartments to facilitate installation and moves, additions, and changes. The compartments shall be removable from the top and back of the floor box. Provide boxes with two (2) cable guides to organize and maintain the cables egress out of the box. Provide boxes with removable knockout plates to allow for the maximum cable pass-through area. The cable pass-through shall be a minimum of 6-16/16 in^2 [176mm^2]. The box shall contain the following number of knockouts: ten (10) 1" trade six, six (6) 1-1/4" trade size, six (6) 3/4" trade size, and two (2) 2" trade size. Boxes shall be fully adjustable, accommodating a maximum 2-inch [51mm] pre-concrete pour and a maximum 1/2" [12.7mm] post-concrete pour adjustment. The box shall be able to accept 2-3/4" x 4-1/2" standard size wall plates. Include mounting brackets with the boxes that will accommodate 15 amp, 20 amp straight blade, 20 amp turn loc, 30 amp straight blade and 30 amp turn loc receptacles, Ortronics® workstation connectivity and modular adapters, a variety of audio/video devices from most manufacturers, and other open system devices.

1. This floor box shall contain three (3) two pole, three wire, 20 amp, 125 volt, NEMA 5-20R duplex receptacles as hereinbefore specified complete with cover plates; four (4) two port modular jack kits complete with two (2) RJ-45 (568A) ports in each, for a total of eight (8) ports.

2. Floor boxes shall be complete with die-cast aluminum Activation Covers. Activation covers shall be available in surface mount and flush versions. Provide covers with two (2) gaskets (one (1) for carpet and one (1) for tile) to go under the trim flange to maintain scrub watertightness. Covers shall be 16-15/16" x 12-1/2" x 3/16" [430mm x 318mm x 4mm]. Covers shall be provided with a carpet recess area in carpeted and tiled areas or a solid lid in non-carpeted/tiled areas. Secure the cover to the flange and enable cover to rotate greater than 180 degrees to reduce trip hazards and provide maximum amount of working space. Provide covers with spring-loaded self-closing slide egress doors to reduce egress opening when cables are exiting and reduce trip hazards. Each of the two (2) egress openings shall have a minimum of 4-in^2 [102mm^2], or a minimum of 8-in^2 [203mm^2] per cover assembly. Covers shall have a powder coat finish with one of the following colors to be selected by the architect.

J. Flush floor outlets designated on the Drawings as "Type K" shall consist of a WIREMOLD Model EFB6S Floor Box or approved equal suitable for use in above grade applications in newly poured concrete floors or raised floors. The floor box shall be manufactured from stamped steel. Boxes shall have the ability to accept a component (EFB610-CTR) that will allow the box to be installed in polished concrete or terrazzo floors. Boxes shall have a polyester based backed enamel finished interior (white). Boxes shall be 15-3/16" L x 13-7/8" W x 4-3/16" H [385mm x 351mm x 107mm]. Provide boxes with provisions that

enable installation into concrete floors, raised floors or wood floors without having to purchase additional components or accessories. Provide boxes with six (6) independent wiring compartments that allow for up to six (6) receptacles, communication and/or audio/video services. Boxes shall permit feed to adjacent compartments. Boxes shall have removable and relocatable dividers to permit custom configuration of compartments as well as permit feed to adjacent compartments. Boxes shall permit feed to compartments on the opposite side of the box through a tunnel. Each of the four (4) outer compartments shall have a minimum wiring capacity of 32-in^3 [524ml]. Each of the two (2) center compartments shall have a minimum wiring capacity of 38.5-in^3 [630ml]. Each of the six (6) compartments shall have a minimum depth of 3-7/8" [98mm] behind the plate. Provide boxes with removable compartments to facilitate installation and moves, additions, and changes. The compartments shall be removable from the top and back of the floor box. Provide boxes with two (2) cable guides to organize and maintain the cables egress out of the box. Provide boxes with removable knockout plates to allow for the maximum cable pass-through area. The cable pass-through shall be a minimum of 6-16/16 in^2 [176mm^2]. The box shall contain the following number of knockouts: ten (10) 1" trade six, six (6) 1- 1/4" trade size, six (6) 3/4" trade size, and two (2) 2" trade size. Boxes shall be fully adjustable, accommodating a maximum 2-inch [51mm] pre-concrete pour and a maximum 1/2" [12.7mm] post-concrete pour adjustment. The box shall be able to accept 2-3/4" x 4-1/2" standard size wall plates. Include mounting brackets with the boxes that will accommodate 15 amp, 20 amp straight blade, 20 amp turn loc, 30 amp straight blade and 30 amp turn loc receptacles, Ortronics® workstation connectivity and modular adapters, a variety of audio/video devices from most manufacturers, and other open system devices.

1. This floor box shall contain three (3) two pole, three wire, 20 amp, 125 volt, NEMA 5-20R duplex receptacles as hereinbefore specified complete with cover plates; one (1) three port modular jack kit complete with two (2) RJ-45 (568A) ports and one (1) F-Connector; and one (1) RAPIDRUN Part No. 2212-43036317-001 cover plate multi-media system outlet consisting of a double brushed aluminum faceplate with female HD15, 3.5mm audio, HDMI connector, and USB connector; and one (1) blank single gang cover plate.

2. Floor boxes shall be complete with die-cast aluminum Activation Covers. Activation covers shall be available in surface mount and flush versions. Provide covers with two (2) gaskets (one (1) for carpet and one (1) for tile) to go under the trim flange to maintain scrub watertightness. Covers shall be 16-15/16" x 12-1/2" x 3/16" [430mm x 318mm x 4mm]. Covers shall be provided with a carpet recess area in carpeted and tiled areas or a solid lid in non-carpeted/tiled areas. Secure the cover to the flange and enable cover to rotate greater than 180 degrees to reduce trip hazards and provide maximum amount of working space. Provide covers with spring-loaded self-closing slide egress doors to reduce egress opening when cables are exiting and reduce trip hazards. Each of the two (2) egress openings shall have a minimum of 4-in^2 [102mm^2], or a minimum of 8-in^2 [203mm^2] per cover assembly. Covers shall have a powder coat finish with one of the following colors to be selected by the architect.

K. Flush floor outlets designated on the Drawings as “Type L” shall be WIREMOLD Cat. No. 8ATC fire-rated Poke-Thru Assembly Unit, for use in existing concrete floors, or approved equal. This assembly consists of an insert and an activation cover. Overall poke-thru assembly length shall be 16 3/4”. The INSERT body shall recess the devices a minimum of 2 3/4” and have a polyester based backing enamel finished interior (ivory). There shall be necessary channels to provide complete separation of power and communication services. There shall be five (5) compartments that allow for up to five (5) duplex receptacles and/or twenty-two (22) communications ports and/or sixteen (16) of Extron® Electronics MAAP™ and/or four (4) AAP™ devices. The body shall consist of an intumescent fire stop material to maintain the fire rating of the floor slab. The intumescent material will be held securely in place in the insert body and shall not have to be adjusted to maintain fire rating of the unit and the floor slab. The insert shall have retaining feature that will hold the poke-thru device in the floor slab without additional fasteners. The poke-thru insert shall also consist of a 3/4” trade size conduit stub that is connected to the insert body and a 24.5 cubic inch stamped steel junction box for wire splices and connections. The stamped steel junction box shall also contain the necessary means to electrically ground the poke-thru device to the system ground. Communication Modules Mounting Accessories: The poke-thru manufacturer shall have available open modular inserts to facilitate mounting UTP (including Category 5, 5e, 6), STP, fiber optic, coaxial, and data/communications devices. Where indicated, provide connectivity outlets and modular inserts by Ortronics or approved equal.

1. This floor box shall contain two (2) proprietary two pole, three wire, 20 amp, 125 volt, NEMA 5-20R duplex receptacles with mounting plates; one (1) duplex mounting plate (8DP) with one (1) two pole, three wire, 20 amp, 125 volt, NEMA 5-20R duplex receptacle to be used in the center compartment; one ‘8TRAC’ device mounting plate for use in the center compartment only, complete with two (2) RJ-45 (568A)TracJack devices, one (1) “F” Connector TracJack device, and three (3) blank TracJack devices; and one (1) ‘8DEC’ device mounting plate for use in the center compartment only, complete with one (1) RAPIDRUN Part No. 2212- 42335-001 multi-media system ‘decorator style’ outlet consisting of a female HD-15, 3.5mm audio and RCA composite video and audio connectors.

2. Flush Floor Poke-Thru shall be complete with die-cast aluminum Activation Covers. Two gaskets (one for carpet and one for tile) shall be provided to go under the trim flange to maintain scrub water tightness. The activation cover shall be 7 1/4” in diameter. The activation covers shall be available in carpet and tile versions. The carpet covers shall be surface mounted and the tile covers shall be flush with the finished floor coverings. The cover shall have spring loaded slides to allow cables to egress out of the unit and maintain as small an egress opening as possible. Covers shall have a powder coat finish with one of the following colors to be selected by the architect.

IV. MULTIPLEX SERVICE FITTINGS

A. Multiplex service fittings designated on the Drawings as Type “1” shall consist of the following field assembled by this Contractor as detailed on the Drawings: one (1) WIREMOLD Cat. No. MP8 dual service fitting or approved equal including housing, base, mounting frames, integral divider, and mounting hardware; one (1) WIREMOLD Cat. No. M-2DR dual duplex opening faceplate; two (2) NEMA 5-20R duplex receptacles as previously specified; one (1) WIREMOLD Cat. No. LTF48-ACT communications face

plate; one (1) WIREMOLD Cat. No. 2A245-C5E dual-port, RJ-45 (568A) workstation insert; two (2) WIREMOLD Cat. No. 2A-BL blank inserts; and two (2) WIREMOLD Cat. No. LTF48-B blank face plates.

B. Multiplex service fittings designated on the Drawings as Type “2” shall consist of the following field assembled by this Contractor as detailed on the Drawings: one (1) WIREMOLD Cat. No. MP4 single service fitting including housing, base, mounting frames, integral divider, and mounting hardware; one (1) WIREMOLD Cat. No. M-2DR dual duplex opening face plate; two (2) NEMA 5-20R duplex receptacles as previously specified; and one (1) WIREMOLD Cat. No. LTF48-B blank face plate.

Part 3 - Execution

I. DEVICE INSTALLATION

A. Before locating outlet boxes, check all of the Drawings for the type of construction and to make sure that there is no conflict with other equipment. The outlet boxes' location shall not interfere with other work or equipment and shall be accessible after completion.

B. Outlet boxes shown on the Drawings to be flush mounted in existing gypsum wallboard partitions shall be installed using metal switch box supports similar to STEEL CITY Cat. No. 820-D.

C. Outlet boxes for devices shown on the Drawings to be installed on opposite sides of the same wall shall be separated horizontally by not less than six (6) inches and if connected with each other, the ends of the raceway shall be filled with sound insulating material after wiring has been installed to fill the voids around the wire. For fire, rated walls provide minimum 24” separation or use approved fire assembly.

D. Provide only the conduit openings necessary to accommodate the conduits at the individual location. Plug any unused openings.

E. Thoroughly coordinate casework and backsplash heights with mounting heights of boxes.

F. Device and outlet boxes shall not be fastened in place with drive pins and/or other methods using compressed air or gases.

G. Device and outlet boxes located under roof decking shall not be less than 1½ inches from the nearest surface of the roof decking.

II. FLUSH FLOOR OUTLET BOXES INSTALLATION

A. Examine conditions under which boxes and fittings are to be installed. Notify the Architect/Engineer in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Strictly comply with manufacturer’s installation instructions and recommendations.

Coordinate installation with adjacent work to ensure proper clearances and to prevent electrical hazards.

C. Floor boxes shall permit all wiring to be completed at floor level. The “FC” models, when used, shall be used as defined by the UL Fire Resistance Directory at a minimum spacing of 24 inches (610 mm) on center.

III. FLUSH FLOOR POKE-THRU ASSEMBLY UNITS

A. Examine conditions under which boxes and fittings are to be installed. Notify the Architect/Engineer in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected. Flush floor poke-thru assemblies require the floor to be core drilled. Coordinate exact locations with the building structure and other trades before core drilling and obtain written approval from the Structural Engineer and Architect before core drilling.

B. Strictly comply with manufacturer’s installation instructions and recommendations. Coordinate installation with adjacent work to ensure proper clearances and to prevent electrical hazards.

C. Units shall permit all wiring to be completed at floor level. Use is defined by the UL Fire Resistance Directory as a minimum spacing of “2 ft. on center and not more than one device per each 65-sq. ft. of floor area in each span.”

D. Poke-thru assemblies installation shall be completed by pushing unit down into the cored hole. The unit shall contain a retainer for securing the device in the slab, as well as the necessary intumescent material to seal the cored hole under fire conditions.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include furnishing and installing wire, metal-clad cable, two-hour fire rated conduit cable, and connectors for all power wiring systems as shown on the Drawings and herein specified.

B. Wiring for data, communication, electronic, fire alarm, or other low voltage and special systems shall be provided as specified in the appropriate specialty Section of these Specifications.

III. QUALITY ASSURANCE

A. All equipment, materials, and their installation shall conform to the requirements of the National Electrical Code (NEC), local code requirements, and these Specifications.

B. All equipment and materials shall be listed by Underwriters Laboratories, Inc. (UL) for their intended use and shall bear the UL label.

C. Equipment shall be constructed in accordance with National Electrical Manufacturer's Association (NEMA) standards.

D. Submittals are required in accordance with SECTION 260500 of these Specifications.

1. Submittals shall include a preliminary schedule to perform the infrared scans described in Part 3 of this specification. The schedule shall be based on the contractual substantial completion date for this project.

Part 2 - Products

I. MATERIALS AND COMPONENTS

A. All conductors shall be new soft drawn high conductivity copper not less than 98% conductivity and shall be delivered to the site in their original unbroken packages plainly marked as follows:

1. UL Label.

2. Size, type and insulation rating of the wire marked every four (4) feet along the length.

3. Name of the manufacturing company and the trade name of the wire.

B. All conductors shall have 600-volt insulation, unless specified otherwise. The minimum operating temperature of the conductor's insulation shall be 75° C.

C. Where conductors are installed in a raceway, in dry and damp locations, conductor insulation shall be rated 75° C. Type THWN or dual rated THWN/THHN.

D. Where conductors are installed in a raceway, exposed to excessive temperatures, conductor insulation shall be rated 90° C. Type THHN, THWN/THHN (dual rated), XHHW or XHHW-2.

E. Where conductors are installed in a raceway, in wet locations, conductor insulation shall be rated 75° C. Type XHHW (wet locations), or XHHW-2 rated 90° C. (dry and wet locations) as appropriate.

F. Conductors on the secondary side of variable frequency drives (VFD) shall be Type XHHW or XHHW-2 as appropriate.

G. The minimum conductor size shall be No. 12 AWG, except for control wiring (minimum size shall be No. 14 AWG), and as stated in other Sections of these Specifications, or as shown on the Drawings. Conductors for 120/277-volt control signals shall not be considered as control wiring.

H. Branch circuits for emergency lighting, including illuminated exit signs, shall be a minimum of No. 10 AWG.

I. Conductors smaller than No. 8 shall be solid; No. 8 and larger shall be stranded.

J. All conductors throughout the project shall be color coded to identify phases, neutral, and ground. Color-coding shall be as follows:

	SYSTEM VOLTAGE	
CONDUCTORS	120/208	277/480
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White	Gray
Ground	Green	Green

K. Insulated conductors size No. 6 A.W.G. and smaller shall have the insulation color-code identification factory applied for the entire length of the conductor. On larger sizes, provide color-coded phasing tape at each box and connection. White or gray colored insulation shall only be used for grounded (neutral) conductors. For multiple

neutrals run in the same conduit, provide separate neutral conductors with a continuous, factory applied tracer stripe matching the color of the respective phase conductor. Green colored insulation shall only be used for equipment grounding conductors.

L. Where conductor size is not indicated, its current carrying capacity shall be equal to or greater than the rating of its overcurrent protective device.

M. Where conductor sizes are increased for voltage drop or other reasons the equipment grounding conductor (when provided) shall be increased in size proportionately.

N. Where conductor sizes are increased for voltage drop they may be reduced in size within ten feet of the termination in order to fit under the lugs available on the overcurrent protective device but not less than the ampacity of the frame size of the overcurrent protective device.

2.2 METAL-CLAD CABLE

A. The Contractor shall furnish and install where shown on the Drawings or specified herein, metal-clad cable, type “MC”, of the size and number of conductors noted on the Drawings. The metal-clad cable shall be a factory assembly of one or more conductors, including a green insulated ground wire enclosed in a galvanized steel interlocked metallic sheath. Metal-clad cable with an aluminum sheath will not be acceptable.

B. Conductors shall be copper with a minimum size of No. 18 A.W.G., solid (through No. 10 A.W.G.) or stranded (No. 8 and larger), Type THHN/THWN (90^{o} C.), and 600 volt. Color-coding of conductors shall be as hereinbefore described.

C. Fittings for metal-clad cable shall be all steel, approved for use with metal-clad cable. Cast pot metal types are not acceptable.

D. Metal-clad cable shall be UL listed and marked in accordance with NEC Article 310.11. Manufacturer’s standard color-coding on the exterior sheath may be used. Metal-clad cable shall be as manufactured by AFC CABLE SYSTEMS or CM & ELKINS (CME) WIRE AND CABLE or SOUTHWIRE COMPANY.

Part 3 - Execution

I. IDENTIFICATION OF CONDUCTORS

A. All branch circuits, including grounded (neutral) conductors, shall be tagged in the panelboards, in all gutters, and in all junction boxes where circuits terminate for the purpose of identifying the various circuits.

B. Feeders and mains shall be tagged in the distribution switchboards, panelboards, and within junction and pull boxes.

C. The method of tagging shall be with an adhesive type of marker. Tagging shall clearly distinguish between 120/208 volt and 277/480 volt conductors.

D. Tags shall be applied after wire is installed in conduit.

E. Where it is impractical to use printed markers on certain wires or cables, use blank type with identification marked thereon in indelible pencil.

II. INSTALLATION

A. Conduit/raceway system shall be complete prior to pulling in wires.

B. Any run of conduit/raceway which does not permit conductors to be pulled in readily shall be condemned and replaced to the satisfaction of the Architect/Engineer and Owner.

C. Conductors shall be continuous between outlets or junction boxes and no splices shall be made except in outlet boxes, junction boxes, and handholes.

D. Do not combine systems of various voltages or circuits from separate sources in the same raceway or conduit system, regardless of the voltage rating of the conductors, unless otherwise shown on the Drawings.

E. All joints, splices and taps for conductor sizes No. 10 and smaller (including luminaire pigtails) shall be connected with approved type crimp connectors, or spring type screw-on connectors (wire-nuts) with insulating skirts; No. 8 and larger shall be connected with solderless THOMAS & BETTS high pressure connectors with heat shrink insulation that possess equivalent or better mechanical strength and insulation ratings than that of the unspliced conductor. Refer to Specification Section 16110 for splices and taps within wiring troughs. The use of pressure connectors is **not** acceptable.

F. Oil, grease or silicon, which could damage the insulation of the conductors or cables, shall not be used when pulling conductors. Use only UL approved cable lubricants approved for the purpose.

G. Train conductors neatly in panelboards, cabinets, and other electrical equipment. Installed conductors shall allow for a minimum of one (1) future re-termination.

III. Tighten pressure type lugs on switchboards, panelboards, motors and other equipment to the manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and 486B.

A. Conductors in vertical conduit runs shall be supported with split-wedge type fittings that clamp each conductor and tighten under the weight of the conductors at intervals required by the NEC.

B. All wiring within the building structure, crawlspaces, and slabs shall be installed in conduit unless indicated or specified otherwise.

C. Homeruns longer than seventy-five (75) feet from a 120/208-volt panelboard or one hundred seventy-five (175) feet from a 277/480-volt panelboard shall be not less than No. 10 AWG, copper.

D. No more than three (3) current carrying phase conductors shall be installed in any one conduit, unless explicitly shown on the drawings.

E. Connect circuits and feeders as shown on the Drawings. Drawings are diagrammatic and do not show every detail required in the wiring system.

F. Install wiring so conductors are not in tension in completed systems.

G. All conductors making up parallel feeders shall be the same size, same type, same insulation and all cut the same length. Bond each group of conductors making up a phase or neutral at both ends in an approved manner. Parallel conductors shall not be run in the same raceway.

H. Provide a separate neutral and grounding conductor (or conduit ground) for all GFI circuits or GFI devices to ensure an adequate ground-fault path.

I. Branch circuits requiring a neutral conductor shall have one neutral conductor per phase conductor when installed in a common raceway, unless specifically shown otherwise on the Drawings.

J. Conductors or cables installed in conduit or tubing exposed to direct sunlight on rooftops require temperature adjustment factors in accordance with the values in NEC 2008 Table 310.15(B)(2)(c).

IV. METAL-CLAD CABLE

A. Metal-clad cable may be used in dry locations for connections in casework, for “fished” applications in existing partitions or walls, above accessible ceilings in classrooms, offices and similar locations and within newly installed drywall partitions. Metal-clad cable may also be used as a “whip” connection from an outlet box (secured to the building structure) to a recessed luminaire (lighting fixture) (minimum, 4 feet; maximum, 6 feet in length) above accessible ceilings in lieu of flexible metal conduit as stated in Section 16110.

B. Metal-clad cable may <u>not</u> be used for feeders, homeruns or within corridors, except for recessed luminaire (lighting fixture) connections as described above. Metal-clad cable shall not be used in areas without a ceiling, in areas without an accessible ceiling or from corridors into adjacent rooms.

C. Metal-clad cable shall be installed and supported in accordance with NEC Article 330.30 and these specifications. Supports shall be zinc-coated or equivalent corrosion protection. Individual hangers, straps or similar fittings shall be used and installed at intervals so as not to damage the cable. Where fastened to walls use appropriate

anchors and screws, the use of drive pins and/or other methods using compressed air or gases are not acceptable. Supports shall **not** terminate or be fastened directly to the roof decking. MC Cable under roof decking shall not be less than 1½ inches from the nearest surface of the roof decking. Supports attached to structural steel joists shall only be attached within 3" of the joist panel points, top or bottom. Supports attached beyond 3" of the joist panel points must be approved, in writing, by the Structural Engineer of record and the Owner before attaching. Staples are not permitted to be used for supports.

D. Bending radius for the metal-clad cable shall be in accordance with NEC Article 330.24.

E. Fittings used for connecting the metal-clad cable to boxes, cabinets, or other equipment shall be all steel UL listed and identified for such use.

F. Metal-clad cable shall be installed parallel or perpendicular to walls. No diagonal runs shall be permitted.

G. Metal-clad cable shall not be installed within three (3) inches of hot water pipes, or appliances, except at crossings where metal-clad cable shall be a least one (1) inch from pipe cover.

H. Metal-clad cable shall not interfere with accessible ceiling tiles. Access to electrical or other equipment shall not be denied by runs of MC cable that prevents removal of panels, including suspended ceiling panels.

I. Flattened, dented, deformed, or open armor is not permitted. If damaged during installation, damaged cables shall be replaced with new undamaged material.

J. Horizontal or cross runs in solid masonry partitions or walls shall not be permitted.

K. All horizontal penetrations through new or existing walls shall be sleeved. No other type of wiring systems shall occupy the same penetration sleeve with the MC cable. Sleeve penetrations through fire-rated walls, after installation of MC cables, shall be fire stopped using a product similar to THOMAS & BETTS "Flame-Safe" fire retardant.

V. FIELD QUALITY CONTROL

A. After installing conductors and cables and before electrical circuitry has been energized, perform the following visual and mechanical inspections:

1. Verify cables and conductors comply with the contract documents.

2. Verify cables and conductors are braced for short circuit stresses where specified.

3. Verify cables and conductors are correctly identified at each termination, splice and tap where applicable.

4. Verify correct phase rotation is maintained throughout project.

5. Verify color coding and identification complies with specifications and the National Electrical Code.

6. Inspect all exposed sections of cables and conductors for physical damage and correct connection.

7. Inspect all bolted and compression connections.

B. Verify phase identification is A, B, C, left to right, front to back and top to bottom. If corrections are required change feeder and branch circuit identification at each end of circuit so that correct phase identification is maintained throughout the project. If incorrect identification is noted on existing systems notify the Architect/Engineer and Owner for action to be taken.

C. Infrared Scanning: After Substantial Completion, but not more than sixty (60) days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger and a complete infrared scan of each panel board, switchboard, and lug terminations of each chiller and motor terminations 20 HP and larger. Remove box and equipment covers so splices and lugs are accessible to portable scanner.

1. Perform a follow-up infrared scan for all splices and terminations previously described approximately eleven (11) months after date of Substantial Completion, but must be during normal school (business) operating hours.

2. Contractor shall submit to the Architect/Engineer and Owner, at time of final inspection, a schedule to perform the infrared scans during normal school (business) operating hours while the building is in full operation, under load. Re-terminations requiring any power shut-downs must be coordinated with the Owner and performed during non-school (business) hours.

3. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Record of Infrared Scanning: Prepare a certified report that identifies equipment and splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken and observations after remedial action.

D. Remove and replace malfunctioning units then verify, inspect and retest as specified above.

END OF SECTION

Underground Electrical Service Section 260543

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include furnishing and installing an underground electrical service complete as shown on Drawings and herein specified.

B. The existing underground and/or overhead electrical service(s) shall remain in operation and shall continue to serve the building during the construction period until the new service has been installed and tested, ready for operation. After the new service has assumed the building's entire power load, the existing service(s) shall be removed as shown on the Drawings.

III. QUALITY ASSURANCE

A. All equipment, materials and their installation shall conform to the requirements of the National Electrical Code (NEC), local code requirements, and these Specifications.

B. All equipment and material shall be listed by Underwriter's Laboratories, Inc. (UL) for their intended use and shall bear the UL label.

C. Equipment shall be constructed in accordance with National Electrical Manufacturer's Association (NEMA) standards.

D. All electrical work specified under this Section of these Specifications shall conform to the requirements of the electric utility company.

E. The grounding systems shall comply with the National Electrical Code (NEC) and as hereinafter specified.

Part 2 - Products

I. ELECTRICAL SERVICE

A. Primary service shall be three phase with pad or pole mounted transformer(s) as shown on the Drawings and shall be furnished by Potomac Electric Power Company in most instances and Baltimore Gas and Electric in selected instances.

B. This Contractor shall furnish and install primary underground service conduits, electric utility company manhole(s) as shown on the Drawings. Electric utility company shall

install all primary service conductors.

C. This Contractor shall furnish and install secondary underground service conduits from the electrical utility company's transformer(s) into the building and extend the service to the metering equipment as shown on the Drawings. Secondary voltage, phase, and number of conduits shall be as shown on the Drawings. Electric utility company shall furnish and install all secondary service conductors, unless otherwise shown on the Drawings to be furnished and installed by this Contractor.

D. All necessary devices, such as meter sockets, meter connection boxes, meter enclosures, current and/or potential transformers, manhole enclosure lid(s), and instrument transformer hangers shall be furnished to this Contractor by the electric utility company.

E. This Contractor shall furnish and install the concrete transformer pad(s), unless other arrangements are made with the electric utility company to have the pads provided by the electric utility company. Contractor provided pads must meet all of the requirements of the electric utility company.

F. This Contractor shall provide pull-lines in all primary and secondary service conduits, including spare raceways. Refer to Specification Section 16110.

II. MATERIALS AND COMPONENTS

A. Primary and secondary electrical service entrance conduits shall be heavy wall (Schedule 40) polyvinyl chloride (PVC) plastic as hereinbefore specified. Secondary electrical service entrance conduits shall be encased in concrete as detailed on the Drawings and specified herein.

B. Concrete for the secondary electrical service entrance ductbank(s) shall be 3,000 psi, air entrained with 3/4-inch maximum aggregate size.

C. Duct spacers shall be fabricated plastic, UL listed.

D. Electrical service entrance conductors, where shown on the Drawings, shall be as hereinbefore specified.

E. Cable lugs for termination of electrical service entrance conductors shall be suitable for the application and as approved by the electrical utility company.

F. Electric utility company manhole enclosures shall be installed, by this contractor, and sized per the electric utility company requirements. Coordinate with the electric utility company.

Part 3 - Execution

I. INSTALLATION

A. This Contractor shall furnish and install a metering system as shown on the Drawings and as required by the electric utility company serving the project.

B. Conduits for the primary and secondary electrical service shall be installed a minimum thirty-six (36) inches below grade, or as required by the electrical utility company.

C. This Contractor shall make all necessary final arrangements with the electric utility company for the installation of the permanent underground electrical service.

D. This Contractor shall coordinate all scheduling of the installation with the electric utility company.

E. Slope installation of electrical service to drain away from the building.

F. Terminate primary and secondary service entrance raceways at transformer location(s) as directed by the electric utility company.

G. This Contractor shall make all necessary final arrangements with the electric utility company for the phased removal of the existing electrical service(s) and associated equipment.

II. DUCTBANK

A. Place concrete so that all voids around ducts are filled.

B. Furnish and install a three (3) inch minimum concrete envelope around ducts with two (2) inch minimum concrete thickness between ducts.

C. Adjust final slopes on site to coordinate with existing and new utilities.

D. Install on undisturbed soil.

E. After installation, clean and swab ducts.

F. Cap spare ducts.

G. Install a minimum thirty-six (36) inches below grade to top of ductbank or as indicated on the Drawing.

III. SERVICE INSTALLATION

A. Furnish and install ductbank and/or conduits as indicated on Drawings complete from service location in building to transformer location(s). Seal raceways watertight at inside face of outside wall or where raceways pierce slab.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include furnishing and installing an underground electrical service complete as shown on Drawings and herein specified.

B. The existing underground and/or overhead electrical service(s) shall remain in operation and shall continue to serve the building during the construction period until the new service has been installed and tested, ready for operation. After the new service has assumed the building's entire power load, the existing service(s) shall be removed as shown on the Drawings.

III. QUALITY ASSURANCE

A. All equipment, materials and their installation shall conform to the requirements of the National Electrical Code (NEC), local code requirements, and these Specifications.

B. All equipment and material shall be listed by Underwriter's Laboratories, Inc. (UL) for their intended use and shall bear the UL label.

C. Equipment shall be constructed in accordance with National Electrical Manufacturer's Association (NEMA) standards.

D. All electrical work specified under this Section of these Specifications shall conform to the requirements of the electric utility company.

E. The grounding systems shall comply with the National Electrical Code (NEC) and as hereinafter specified.

Part 2 - Products

I. ELECTRICAL SERVICE

A. Primary service shall be three phase with pad or pole mounted transformer(s) as shown on the Drawings and shall be furnished by Potomac Electric Power Company in most instances and Baltimore Gas and Electric in selected instances.

B. This Contractor shall furnish and install primary underground service conduits, electric utility company manhole(s) as shown on the Drawings. Electric utility company shall

install all primary service conductors.

C. This Contractor shall furnish and install secondary underground service conduits from the electrical utility company's transformer(s) into the building and extend the service to the metering equipment as shown on the Drawings. Secondary voltage, phase, and number of conduits shall be as shown on the Drawings. Electric utility company shall furnish and install all secondary service conductors, unless otherwise shown on the Drawings to be furnished and installed by this Contractor.

D. All necessary devices, such as meter sockets, meter connection boxes, meter enclosures, current and/or potential transformers, manhole enclosure lid(s), and instrument transformer hangers shall be furnished to this Contractor by the electric utility company.

E. This Contractor shall furnish and install the concrete transformer pad(s), unless other arrangements are made with the electric utility company to have the pads provided by the electric utility company. Contractor provided pads must meet all of the requirements of the electric utility company.

F. This Contractor shall provide pull-lines in all primary and secondary service conduits, including spare raceways. Refer to Specification Section 16110.

II. MATERIALS AND COMPONENTS

A. Primary and secondary electrical service entrance conduits shall be heavy wall (Schedule 40) polyvinyl chloride (PVC) plastic as hereinbefore specified. Secondary electrical service entrance conduits shall be encased in concrete as detailed on the Drawings and specified herein.

B. Concrete for the secondary electrical service entrance ductbank(s) shall be 3,000 psi, air entrained with 3/4-inch maximum aggregate size.

C. Duct spacers shall be fabricated plastic, UL listed.

D. Electrical service entrance conductors, where shown on the Drawings, shall be as hereinbefore specified.

E. Cable lugs for termination of electrical service entrance conductors shall be suitable for the application and as approved by the electrical utility company.

F. Electric utility company manhole enclosures shall be installed, by this contractor, and sized per the electric utility company requirements. Coordinate with the electric utility company.

Part 3 - Execution

I. INSTALLATION

A. This Contractor shall furnish and install a metering system as shown on the Drawings and as required by the electric utility company serving the project.

B. Conduits for the primary and secondary electrical service shall be installed a minimum thirty-six (36) inches below grade, or as required by the electrical utility company.

C. This Contractor shall make all necessary final arrangements with the electric utility company for the installation of the permanent underground electrical service.

D. This Contractor shall coordinate all scheduling of the installation with the electric utility company.

E. Slope installation of electrical service to drain away from the building.

F. Terminate primary and secondary service entrance raceways at transformer location(s) as directed by the electric utility company.

G. This Contractor shall make all necessary final arrangements with the electric utility company for the phased removal of the existing electrical service(s) and associated equipment.

II. DUCTBANK

A. Place concrete so that all voids around ducts are filled.

B. Furnish and install a three (3) inch minimum concrete envelope around ducts with two (2) inch minimum concrete thickness between ducts.

C. Adjust final slopes on site to coordinate with existing and new utilities.

D. Install on undisturbed soil.

E. After installation, clean and swab ducts.

F. Cap spare ducts.

G. Install a minimum thirty-six (36) inches below grade to top of ductbank or as indicated on the Drawing.

III. SERVICE INSTALLATION

A. Furnish and install ductbank and/or conduits as indicated on Drawings complete from service location in building to transformer location(s). Seal raceways watertight at inside face of outside wall or where raceways pierce slab.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include furnishing and installing power pole systems using Tele-Power Poles and/or Vertical Chase Power Communications Delivery Systems (multi-outlet systems) in steel and aluminum, used to provide branch circuit wiring, convenience power outlets, multi-media and other low voltage communications wiring and outlets as shown on the Drawings and herein specified.

1. Tele-Power Poles shall consist of the Tele-Power Pole Multi-Outlet Assembly, appropriate fittings and accessories to complete the installation.

2. Vertical Chase Power Communications Delivery Systems (multi-outlet systems) assemble shall consist of modular vertical channels, and appropriate fittings. The system shall consist of a pre-punched support, aluminum end covers and a metallic center panel, which can be adorned with laminate products. Options may include furniture feeds or wired receptacle harnesses, and appropriate fittings to complete the installation.

III. QUALITY ASSURANCE

A. All equipment, materials, and their installation shall conform to the requirements of the National Electrical Code (NEC), local code requirements, and these Specifications.

B. All equipment and materials shall be listed by Underwriters Laboratories, Inc. (UL) for their intended use and shall bear the UL label.

C. Equipment shall be constructed in accordance with National Electrical Manufacturer's Association (NEMA) standards.

D. Submittals are required in accordance with SECTION 260500 of these Specifications.

IV. DELIVERY, STORAGE AND HANDLING

A. Deliver power pole systems in factory labeled packages.

B. Store and handle in strict compliance with manufacturer's written instructions and recommendations.

C. Protect from damage due to weather, excessive temperature, and construction operations.

Part 2 - Products

2.1 MANUFACTURERS

A. Power Pole Systems shall be as manufactured by THE WIREMOLD COMPANY, as described herein as the basis of design, or equal product as manufactured by HUBBELL INCORPORATED.

B. All components and fittings shall be of the same manufacturer, or UL listed as an assembly.

2.2 TELE-POWER POLES

A. The Tele-Power Pole shall be WIREMOLD Cat. No. 30TP-4V.

1. The Tele-Power Pole channel shall be steel, ivory baked enamel finish with a cross section of 3" x 2.75" with two (2) separate compartments. One compartment is to be factory wired with two (2) duplex 2 pole, 3 wire, 20A, 125V NEMA 5-20R receptacles (Pass & Seymour Cat. No. 5362AI), ivory colored to match the pole finish. The harness is to be single circuit (2 conductor plus ground) with #12 AWG solid type THHN conductors, factory assembled to the receptacles, unless otherwise shown on the Drawings. Minimum 6" conductor leads shall be furnished for termination to the overhead wiring system.

2. The second compartment shall be for field installation of low voltage communications cabling. A 12" removable cover section in this compartment must be provided to assemble and mount communications connectors. This section must be removable without dismantling or removing the Tele-Power Pole after installation. The cover section is to have four (4) knockouts for modular voice-data, video, multi-media outlets or ports and a 1.375" x 2.7" rectangular knockout for a modular furniture outlet. A "mouse hole" knockout with furnished grommet shall be included for straight through communication cable access.

3. The Tele-Power Pole shall be 10'-5" or 12'-5" long to suit the location installed.

B. Fittings: A full complement of fittings for the Tele-Power Pole shall include, but not limited to, entrance end fitting for top of the electrical channel, ceiling trim plate, pole-mounted bracket, Velco™ carpet gripper pad and adhesive pad. Provide all fittings necessary for a complete installation.

1. If for air handling spaces, an entrance end fitting must be furnished for the low voltage communications channel.

C. Add-On Device Covers:

1. The Tele-Power Pole must be UL Listed for field modification, changes and additions of receptacles, devices and circuits. Field installed device plates shall be available to add duplex, single 1.40” and 1.59” diameter, and rectangular type receptacles. These plates must be ivory in color to match the pole.

2. Add-on communications covers must be available to mount workstation device faceplates, inserts, and specialty mounting bezels. The power pole manufacturer shall provide a complete line of connectivity outlets and multi-media modular inserts for UTP, fiber optic, coaxial, and other cabling types to suit the project requirements.

3. UTP inserts shall feature a unique recessed area for port labeling and shall be able to accommodate designation icon buttons or icon labels. Custom label capabilities shall be available using templates that can be downloaded from the Internet.

2.3 VERTICAL CHASE POWER & COMMUNICATIONS DELIVERY ASSEMBLIES

A. The Vertical Power & Communications Deliver Assemblies shall be the WIREMOLD VISTA ARCHITECTURAL COLUMN SYSTEM SERIES. [Engineer, provide a complete catalog number here or on the drawings if more than one type is needed for the project]

B. Frames shall be mill finished 6063-T6 aluminum with snap on steel and/or aluminum covers and satin anodized aluminum end caps. Covers and access panels may also be painted over and are suitable for field painting.

1. The frame shall be a four (4) piece design with two center supports and snap-on covers and end caps, yielding a total of three (3) useable wire and cable channels. The product shall be available in two (2) sizes – small and large, as shown on the Drawings or indicated herein. The total small width shall be 8.9” x 3.8” deep. The large size shall be 13.4” wide x 3.8” deep. The aluminum extrusions shall be a minimum thickness of 0.06”, and steel covers 0.040”. The system shall be available in 10’-6” height. The system shall be provided with an extension kit that includes aluminum tubes to allow for varying ceiling heights up to 15’-0” where needed. Access panels and covers

up to a height of 30” above finished floor shall provide access to wiring and devices.

2. The frame supports shall include factory pre-punched hole cuts for communication receptacles and trade knockouts for electrical termination.

C. The panels finish and colors shall be as selected by the Architect/Engineer or as shown on the Drawings. The finishes and panels availability shall be as follows:

1. The center panels shall be constructed of painted steel, aluminum or stainless steel in 96”, 30”, 24”, and 6” heights. The center panel finishes available from the manufacturer shall include wood laminate, metal laminate, nonmetallic laminate, fabric, and a painted surface. Perforated metal in painted steel and glass panels shall be available for the upper sections. An open center option shall also be offered. This option consists of a metallic panel from the floor to 30” high. The remainder of the center section is open to the ceiling. [Engineer to coordinate with the Architect and edit as needed. If necessary develop types to be used if they are more than one type. A schedule on the drawings may need to be developed with catalog numbers if not done above.]

D. A full complement of fittings shall include, but not limited to, internal braces with knockouts, snap-in dividers and wire clips, ceiling and carpet trim pieces. The fittings shall be manufactured of extruded aluminum, galvanized steel, and/or plastic.

E. Multi-outlet wiring harnesses shall consist of 2 pole, 3 wire, 20A, 125V NEMA 5- 20R receptacles (Pass & Seymour Cat. No. 5362AI). The harness shall be a single circuit (2 conductor plus ground) or two circuit (4 conductor plus ground) wiring configurations as indicated on the Drawings. The wires shall be #12 AWG solid type THHN conductors, factory assembled to the receptacles.

F. A plate with openings and knockouts shall be provided for a furniture feed option, when shown on the Drawings, to feed a modular furniture system.

Part 3 - Execution

I. EXAMINATION

A. Examine conditions under which power pole systems, accessories, and fittings are to be installed and substrate that will support systems. Notify the Architect/Engineer and Owner of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected.

II. INSTALLATION

A. Prior to and during installation, refer to the system layout drawing containing all elements of the system. Contractor shall comply with detailed manufacturer’s instruction sheets, which shall accompany system components as well as complete system instruction sheets, using whichever is applicable. Coordinate installation with adjacent

work to ensure proper clearances and to prevent electrical hazards.

B. System poles shall be plumb and securely supported at the ceiling and the floor in accordance with manufacturer's installation sheets.

C. All systems shall be mechanically continuous and connected to all electrical outlets, boxes, device mounting brackets, and cabinets, in accordance with manufacturer's installation sheets.

D. The system shall be electrically continuous and bonded in accordance with the National Electrical Code for proper grounding.

E. Provide accessories as required for a complete installation, including insulated bushings and inserts where required by the manufacturer.

F. Close all unused openings where wire is exposed using manufacturer's recommended accessories.

III. CLEANING AND PROTECTION

A. Clean surfaces using non-abrasive materials and methods recommended by manufacturer.

B. Protect power poles until final acceptance by the Owner.

C. Repaint marred and scratched surfaces with touch-up paint to match original finish.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include furnishing and installing wiring devices, for all electrical systems as shown on the Drawings and herein specified. This Section includes the following:

1. Lighting Switches
2. Motor Switches
3. Wall Dimmer Switches
4. Receptacles, receptacles with integral GFCI, and associated device plates Twist-locking receptacles.
5. Cover Plates
6. Wall Plates
7. Cord and plug sets.

III. QUALITY ASSURANCE

A. All equipment, materials, and their installation shall conform to the requirements of the National Electrical Code (NEC), local code requirements and these Specifications.

B. All equipment and materials shall be listed by Underwriters Laboratories, Inc. (UL) for their intended use and shall bear the UL Label.

C. All 125 volt and 250 volt, 15 amp and 20 amp receptacles (NEMA 5-15R, 5-20R, 6-15R, 6-20R, L5-15R, and L5-20R) shall be FSUL WC-596-G compliant and bear the FSUL label.

D. All non-locking 125 volt and 250 volt, 15 amp and 20 amp receptacles (NEMA 5- 15R, 5-20R, 6-15R and 6-20R) located in damp or wet locations shall be UL Listed as “weather resistant”.

E. All lighting switches shall be FSUL WS-896 compliant and bear the FSUL label.

F. Equipment shall be constructed in accordance with National Electrical Manufacturer's Association (NEMA) standards.

G. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

H. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use. Comply with NFPA 7.

IV. DEFINITIONS

A. EMI: Electromagnetic interference.
B. GFCI: Ground-fault circuit interrupter.
C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
D. RFI: Radio-frequency interference.

V. SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Submittals are required in accordance with SECTION 16010 of these Specifications.

1. Certain wiring devices and other equipment listed hereinafter may not be part of this project. This Contractor shall select from the listed devices the equipment necessary to be compliant with the Contract Documents and include in the submittals only the devices and equipment specific for this project.

2. Field quality-control test reports.

3. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

Part 2 - Products

I. LIGHTING SWITCHES

A. Lighting switches shall be manufactured by PASS & SEYMOUR (P&S) as listed below or the equivalent as manufactured by COOPER (ARROW HART), HUBBELL, or LEVITON.

B. Lighting switches shall be totally enclosed, 20 amp, 120-277 volt with screw-type wire terminals to accept No. 14 through No. 10 AWG solid copper conductors, ivory thermoplastic toggle, and grounding terminal, or Plug Tail Type. All locking type switches

shall be keyed alike. Lighting switches shall be as follows:

1. Single pole P&S Cat. No. PS20AC1I
2. Single Pole (PlugTail Type) PT20AC1I
3. Single pole, locking type P&S Cat. No. PS20AC1IL
4. Single pole, double throw- P&S Cat. No. 1221I Two circuit, center off
5. Three –way P&S Cat. No. PS20AC3I
6. Three-way (PlugTail Type) PT20AC3I
7. Three-way, locking type P&S Cat. No. PS20AC3IL
8. Four-way P&S Cat. No. PS20AC4I
9. Four-way, locking type P&S Cat. No. PS20AC4IL
10. Momentary contact P&S Cat. No. 1251I
11. Momentary contact, P&S Cat. No. 1251L locking type

C. All PlugTail lighting switches shall come complete minimum six (6) inch solid THHN Connector. Stranded connectors shall not be acceptable.

D. Pilot lighting switches shall be totally enclosed, 20 amp, 120 volt and 277 volt with screw type wire terminals to accept No. 14 through No. 10 AWG solid copper conductors, red “lighted when ON” lighted toggle, and grounding terminal. Pilot lighted switches shall be as follows:

1. Single pole (120V) P&S Cat. No. PS20AC1RPL
2. Single pole (277V) P&S Cat. No. PS20AC1RPL7
3. Three-way (120V) P&S Cat. No. PS20AC3RPL
4. Three-way (277V) P&S Cat. No. PS20AC3RPL7

E. Digital lighting control switches required under Specification SECTION 16505 shall be part of the lighting control system.

F. Wall switch occupancy sensors are specified under Specification SECTION 16506.

II. MOTOR SWITCHES

A. Motor switches shall be totally enclosed, 30 amp, 600 volt with screw-type wire terminals to accept solid copper conductors and a grounding terminal. Motor switches shall be as follows:

1. Single phase, Double pole P&S Cat. No. 7802MD

2. Three phase, Three pole P&S Cat. No. 7803MD

B. Motor switches shall include a red pilot light with the switch or on a separate mounting strap in a two-gang outlet box and suitable cover plate. Pilot light shall glow red when switch is ON. Pilot lights shall be suitable for the voltage supplied to the motor switch. Pilot light on a separate mounting strap shall be P&S Cat. No. 2151RED or approved equal.

C. Mechanical door limit switches shall be Mars Corporation Part No. 99-014 – 250 volt, 1 phase, 20 amp, 1 HP max or approved equal.

III. WALL DIMMER SWITCHES

A. Wall dimmer switches shall be LUTRON “Nova” Type with gray faceplate incandescent, fluorescent or L.E.D. of the wattage (incandescent) or number of lamps (fluorescent) as noted on the Drawings or approved equal by PASS & SEYMOUR.

IV. RECEPTACLES

A. Receptacles shall be manufactured by PASS & SEYMOUR (P&S) as listed below or the equivalent as manufactured by COOPER (ARROW HART), HUBBELL, or LEVITON.

B. All straight blade 15A and 20A receptacles in elementary schools only, shall be tamper-resistant type, except clock outlet receptacles.

C. Receptacles shall be of the types listed below, complete with an impact resistant nylon face, screw type wire terminals to accept copper conductors, high strength thermoplastic back body, and grounding terminal, or Plug Tail Type.

1. Duplex 2P, 3W, 20A, 125V, NEMA 5-20R: P&S Cat. No. 5362-AI

2. Duplex (PlugTail Type), 2P, 3W, 20A, 125V, NEMA 5-20R: P&S Cat. No. PT5362-AI

3. Controlled Receptacle, Duplex 2P, 3W, 20A, 125V, NEMA 5-20R: P&S Cat. No. 5362-AGRY

4. Controlled Receptacle (PlugTail Type), Duplex 2P, 3W, 20A, 125V, NEMA 5-20R: P&S Cat. No. PT5362-AGRY

5. Duplex 2P, 3W, 20A,125V, NEMA 5-20R Tamper-Resistant (safety) type with two USB Charging Ports: P&S Cat. No. TR5362USBI

6. Duplex 2P, 3W, 20A, 125V, NEMA 5-20R Weather-Resistant: P&S Cat. No. WR5362I

7. Duplex 2P, 3W, 20A, 125V, NEMA 5-20R Ground Fault Circuit Interrupter type with Safe Lock: P&S Cat. No. 2095I

8. Duplex (Plugtail Type) 2P, 3W, 20A, 125V, NEMA 5-20R Ground Fault Circuit Interrupter type with Safe Lock: P&S Cat. No. PT2095I

9. Duplex 2P, 3W, 20A, 125V, NEMA 5-20R Connected to an emergency circuit: P&S Cat. No. 5362-ARED

10. Duplex (Plugtail Type) 2P, 3W, 20A, 125V, NEMA 5-20R Connected to an emergency circuit: P&S Cat. No. PT5362-ARED

11. Duplex 2P, 3W, 20A, 125V, NEMA 5-20R Tamper-Resistant (safety) type: P&S Cat. No. TR63I

12. Duplex (PlugTail Type), 2P, 3W, 20A, 125V, NEMA 5-20R Tamper-Resistant (safety) type: P&S Cat. No. PTTR63I

13. Controlled Receptacle, Duplex 2P, 3W, 20A, 125V, NEMA 5-20R Tamper-Resistant (safety) type: P&S Cat. No. TR63GRY

14. Controlled Receptacle Duplex (PlugTail Type), 2P, 3W, 20A, 125V, NEMA 5-20R, Tamper-Resistant (safety) type: P&S Cat. No. PTTR63I

15. Duplex 2P, 3W, 20A, 125V, NEMA 5-20R Tamper-Resistant (safety), Ground Fault Circuit Interrupter type with Safe Lock: P&S Cat. No. 2095TRI

16. Duplex 2P, 3W, 20A, 125V, NEMA 5-20R Tamper-Resistant (safety), Ground Fault Circuit Interrupter type with Safe Lock: P&S Cat. No. PT2095TRI

17. Duplex 2P, 3W, 20A, 125V, NEMA 5-20R Weather-Resistant and Tamper-Resistant, Ground FaultCircuit Interrupter type with Safe Lock: P&S Cat. No. 2095TRWRI

18. Single 2P, 3W, 20A, 125V, NEMA 5-20R connector: P&S Cat. No. 5369-X

19. Single 2P, 3W, 15A, 125V, NEMA L5-15R: P&S Cat. No. 4710

20. Single 2P, 3W, 20A, 125V, NEMA L5-20R: P&S Cat. No. L520R

21. Single 2P, 3W, 20A, 125V, NEMA L5-20R connector: P&S Cat. No. L520C

22. Single 2P, 3W, 30A, 125V, NEMA 5-30R: P&S Cat. No. 3802

23. Single 2P, 3W, 30A, 125V, NEMA L5-30R: P&S Cat. No. L530R

24. Single 2P, 3W, 15A, 250V, NEMA 6-15R: P&S Cat. No. 5662AI

25. Single 2P, 3W, 20A, 250V, NEMA 6-20R: P&S Cat. No. 5862AI

26. Single 2P, 3W, 30A, 250V, NEMA 6-30R: P&S Cat. No. 3801

27. Single 2P, 3W, 50A, 250V, NEMA 6-50R: P&S Cat. No. 3804

28. Single 3P, 4W, 20A, 125/250V, NEMA 14-20R: P&S Cat. No. 3820
29. Single 3P, 4W, 30A, 125/250V, NEMA 14-30R: P&S Cat. No. 3864
30. Single 3P, 4W, 50A, 125/250V, NEMA 14-50R: P&S Cat. No. 3894
31. Single 3P, 4W, 60A, 125/250V, NEMA 14-60R: P&S Cat. No. 3871
32. Single 3P, 4W, 20A, 250V, NEMA 15-20R: P&S Cat. No. 3821
33. Single 3P, 4W, 30A, 250V, NEMA 15-30R: P&S Cat. No. 5740
34. Single 3P, 4W, 50A, 250V, NEMA 15-50R: P&S Cat. No. 5750
35. Single 3P, 4W, 60A, 250V, NEMA 15-60R: P&S Cat. No. 5760
36. Single 3P, 4W, 50A, 125/250V P&S Cat. No. CS6369.
37. Single 2P, 3W, 15A, 125V, NEMA 5-15R Wireless Clock Outlet with stainless steel cover plate: P&S Cat. No. S3733-SS

D. Wiring devices mounted in WIREMOLD V4000 surface metal raceways shall be ivory or light almond in color to match the raceway in lieu of the colors indicated above, except red wiring devices shall not change.

E. All PlugTail receptacles shall come complete minimum six (6) inch solid THHN Connector. Stranded connectors shall not be acceptable.

V. COVER PLATES

A. Single and combination types to match corresponding wiring devices.

B. Plate-Securing Screws: Metal with head color to match plate finish.

C. A cover plate shall be furnished and installed over each wiring device Plates shall be PASS & SEYMOUR Type 302 (non-magnetic) stainless steel with satin finish, 0.032" nominal thickness or the equivalent as manufactured by COOPER (ARROW HART), HUBBELL, LEVITON or MULBERRY. All cover plates shall be UL listed.

1. Wall switch occupancy sensors shall have stainless steel cover plates, not the plastic cover plates that may be included in the switch packaging.

D. Cover plates shall be of a configuration to match the type of wiring device to be covered. Where more than one flush outlet (switch, receptacle, etc.) is indicated in the same location and at the same mounting height, all (except dimmer switches) shall be ganged in a single multi-gang outlet box under a common cover plate.

E. Wiring devices located in wet or damp locations, or noted "WP" on the Drawings shall be complete with a die-cast weatherproof metallic cover plate. Receptacles in damp locations only, may use this type of weatherproof cover plate. All weatherproof cover plates shall be UL listed. All 15 amp and 20 amp receptacle type wiring devices located in

wet locations, or noted “WP” on the Drawings, shall have hinged weatherproof “while-in-use” covers, Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather.

F. Other receptacle type wiring devices located in wet and damp locations where equipment is intended to be plugged into it and not attended while in use shall also have hinged weatherproof “while-in-use” covers, Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather. Provide these types of weatherproof covers at other locations identified on the Drawings. Covers, body and plates shall be gray die-cast aluminum, fully gasketed and suitable for mounting horizontally and vertically. Mounting screws shall be 302 stainless steel. Cover assembly shall be UL listed.

G. All receptacles on an emergency circuit shall have a cover plate, PASS & SEYMOUR Type 302 (non-magnetic), labeled with 1/8” high engraved and filled lettering “EMERGENCY”.

H. Cover plates for receptacles shall be labeled with the circuit number including panelboard designations. Labeling shall be done with a BROTHER® Model No. PT-1400 (P-touch) professional label maker, or approved equal, using a laminated type extra strength adhesive tape, Letters/numerals shall be black with a white background, minimum 3/16” high. Locations/rooms requiring labels shall be as follows:

1. Elementary schools:

   a) All classrooms and instructional spaces.

   b) Media Centers/Libraries, excluding offices, conference rooms and other ancillary spaces associated with the Media Center.

2. Middle and High Schools:

   a) Lecture Halls.

   b) Media Centers/Libraries, excluding offices, conference rooms and other ancillary spaces associated with the Media Center.

   c) Multi-Purpose Classrooms.

I. Cover plates for lighting control digital switches shall be labeled with the lighting control panel designation and room number designation or as shown on the Drawings. Labeling shall be done with a BROTHER® Model No. PT-1400 (P- touch) professional label maker, or approved equal, using a laminated type extra strength adhesive tape, Letters/numerals shall be black with a white background, minimum 3/16” high.

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper)

2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell)

3. Leviton Mfg. Company Inc. (Leviton).

4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour)

VI. POWER OUTLET PANELS

A. Power Outlet Panels shall have one duplex 2P, 3W, 20A, 125V, NEMA 5-20R weather-resistant and tamper-resistant, Ground Fault Circuit Interrupter (GFCI) type receptacle; P&S Cat. No. 2095TRWR or equal.

B. Enclosure shall be rainproof NEMA 3R and fabricated from G90 galvanized steel with welded flange construction and a gray powder coat finish. The door cover shall swing up and able to be held in the open position and closed with plugs and cords inserted into the receptacle while maintaining the NEMA 3R rating. The door shall have rolled edges to protect cords from damage and with padlock provisions. The deadfront cover shall be angled with the receptacle to facilitate easier plug and cord attachments and shall be removable without interfering with factory wiring.

C. All components shall be factory wired and have field termination lugs, including ground lug.

D. Power Outlet Panels shall be MIDWEST ELECTRIC PRODUCTS, INC. Catalog No. U010SEP or approved equal.

VII. CORD REELS

A. Cord reels designated on the Drawings as ‘CR’ shall be WOODHEAD Cat. No. 990-3000, having an open housing, a minimum 18-inch primary power cord and a NEMA 5-15P plug cap, a shock-absorbing ball stop, adjustable tension, built in ratchet locks, a swivel/pivot base (Cat. No, 9507), and a forty-five (45) foot secondary power cord (rated 11 amps, minimum) with an attached non- conductive rubber and plastic power outlet box having two (2) 2P, 3W, 15A duplex receptacles (NEMA 5-15R). The power cords shall be SJTOW’ type with three (3) conductor, No. 14 AWG.

1. This Contractor shall furnish and install a NEMA 5-15R single receptacle in/on the ceiling as shown on the Drawings for plugging in the cord reels primary cord.

2. Contractor shall activate ratchet if not set by the factory.

B. Cord reels designated on the Drawings, as ‘CRL’ shall be WOODHEAD Cat. No. 980A-83, having an open housing with an automatic ‘on/off’ power switch located inside the reel, a minimum 18-inch primary power cord and a NEMA 5-15P plug cap, a shock-absorbing ball stop, adjustable tension, built in ratchet locks, a swivel/pivot base (Cat. No, 9507), and a fifty (50) foot secondary power cord with an attached 13-watt fluorescent hand lamp having vinyl coated guard and rubber handle without a receptacle in the handle suitable for use in minor repair garages classified as a non-hazardous location per NEC Article 511.3(D)(1). The power cords shall be ‘SJTOW’’ type with three (3) conductor, No. 16 AWG.

1. This Contractor shall furnish and install a NEMA 5-15R single receptacle in/on the ceiling as shown on the Drawings for plugging in the cord reels primary cord.

2. Contractor shall activate ratchet if not set by the factory.

VIII. DOORBELL SYSTEM

A. This Contractor shall furnish and install where shown on the Drawings, a complete doorbell signaling system as specified herein:

1. Bell: Edwards Signaling Cat. No. 340-6G5 Adaptable. Bell shall be six (6) inches in diameter, 24 volts AC, having a sound level of 92 dB measured at 10 feet.

2. Class 2 Signaling Transformer: Edwards Signaling Cat. No. 592. Transformer shall have primary voltage of 120 volts AC and secondary voltage of 24 volts AC and 20 VA.

3. Pushbutton Station: Edward Signaling Cat. No. 1786C-B. Pushbutton shall be weatherproof, surface mount, and solid brass construction. The pushbutton shall have normally open momentary contacts, rated at 24 volts, 4 amps AC, 2 amps DC, a neoprene diaphragm to protect the internal phosphor bronze contact springs, and a bakelite back plate threaded for ½ inch conduit.

IX. FIRE EVACUATION STAGING AREA (FESA) VISUAL NOTIFICATION SYSTEM

A. This Contractor shall furnish and install where shown on the Drawings, a complete FESA visual notification system as specified herein:

1. Signal Beacon: Federal Signal Corporation Model No. FB2PST-120R exterior red strobe light rated at 120VAC, 0.25 amps, flash rate/minute of 90, candela ratings of 1,000,000 (peak) and 300 ECP (effective candela) suitable for mounting on ½" NPT pipe.

2. Wall Mounting Bracket Kit: Federal Signal Corporation Model No. LWMB2 wall mounting bracket for mounting the FESA exterior strobe light signal beacon. The wall bracket shall be wall mounted on a suitable outlet box and shall allow wiring to be run concealed within the wall bracket to the strobe light.

3. Activation Station (on/off): STI Model No. SS-2231 with custom two (2) line label to read "FESA" (line 1), "SIGNAL BEACON" (line 2) and a STI Model No. SUB-102722 Spacer (color to match shell). Mount over flush outlet box or surface mounted on Wiremold V5744S outlet box where indicated on the Drawings or required to be surface mounted.

4. Transformer: Provide a transformer, when required to step down the voltage from 277 volts to 120 volts. Transformer shall be equal to ACME ELECTRIC Catalog No. TB81301 rated at 50 VA, 277 volts primary to 120 volts secondary complete with a primary fuse block, Part No, PL112700 and 0.6-amp time delay class CC fuses. Mount transformer and fuse block in a metal NEMA 1 vented enclosure with a latching hinged cover, HOFFMAN Catalog No. A8N66/A8N6P with HOFFMAN Catalog No. AVK23 louver vents field installed on two (2) side walls of enclosure. Mount enclosure above the ceiling or as shown on the Drawings.

X. S.O.L TESTING PORTABLE POWER DISTRIBUTION BOX (middle and high schools only)

A. S.O.L. testing portable power distribution boxes shall contain a minimum of six (6) NEMA

5-20R duplex receptacles, one (1) NEMA L5-30R single receptacle, one (1) 50A 125/250V locking inlet (CS6375) and one (1) 50A 125/250V locking outlet (CS6369). A circuit breaker panel box with a hinged door cover shall be provided. Each NEMA 5-20R duplex receptacle shall be protected by one (1) single pole, 20A circuit breaker and each NEMA L5-30R single receptacle shall be protected by one (1) 2 pole, 30A circuit breaker. The power distribution box shall have individual GFCI modules to protect the duplex receptacles against ground faults with manual GFCI reset configuration.

B. The power distribution box shall be suitable for indoor or outdoor environments. Box shall have a reinforced steel housing and support legs and finished with a powder coat paint inside and out to prevent corrosion.

C. Each portable power distribution box shall have one (1) factory assembled 50A, 125/250V, 50 ft. min. length cordset for connecting the unit from a CS6369 wall receptacle to the inlet (CS6375) of the power distribution box.

D. An S.O.L. testing portable power distribution box that meets this specification is a COOPER (ARROW HART) Cat. No. RB300M with PC50A cordset or as equal by ERICSON, or HUBBELL. This contractor shall furnish one (1) unit for each S.O.L. 50A receptacle shown on the Drawings.

Part 3 - Execution

I. WIRING DEVICES

A. This Contractor shall furnish and install all wiring devices, material, and hardware as indicated on the Drawings, as specified, or as required for a complete installation.

B. Before installation, the exact type of wiring devices shall be coordinated with all associated trades.

C. This Contractor shall check all wiring devices for damages during construction and replace where necessary. All devices shall be cleaned and left in a complete operable condition.

D. This Contractor shall verify all door swings before installing lighting switches.

E. Receptacles shall be installed only on clear wall spaces, not in tackboards, chalkboards, pipe chases, mechanical equipment, or built-in type furniture and cabinets. If receptacles are shown on the Drawings to be installed therein, this Contractor shall call it to the attention of the Architect/Engineer and obtain a new location.

F. Dimmer switches shall not be ganged together with other types of lighting switches. Multiple dimmer switches shall be ganged together using the number of outlet boxes and/or outlet box gangs in accordance with the manufacturer's instructions.

II. DEVICE INSTALLATION

A. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.

B. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.

C. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.

D. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.

E. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.

F. Use a torque screwdriver when a torque is recommended or required by the manufacturer.

G. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.

H. Tighten unused terminal screws on the device.

I. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

III. RECEPTACLE ORIENTATION

A. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the left.

B. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

C. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

D. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

IV. POWER OUTLET PANELS

A. This Contractor shall furnish and install power outlet panels, material, and hardware as indicated on the Drawings, as specified, and as required for a complete installation. Power outlet panels generally will be mounted on the roof with the free-standing safety switch assembly as detailed on the Drawings or other locations shown on the Drawings.

B. All mounting openings not used must be permanently sealed to keep rain, moisture, insects, etc. from entering the box housing. The use of stainless steel screws/nuts with

rubber washers and silicone sealant may be used, or another approved method for a completely sealed box housing.

V. S.O.L 50A POWER RECEPTACLES

A. S.O.L. 50A receptacles shown on the Drawings as TYPE ‘A’ shall be complete with a spring loaded self-closing die-cast flip cover. Label each receptacle cover to read “S.O.L. TESTING”.

B. S.O.L. 50A receptacles shown on the Drawings as TYPE ‘B’ and associated outlet box shall be installed within a flush recessed HOFFMAN box with a hinged cover. Label each HOFFMAN box to read “S.O.L. TESTING” on the exterior of the box.

VI. CONNECTIONS

A. Ground equipment according to Specification Section 16460 “Grounding” and the National Electrical Code.

B. Connect wiring according to Specification Section 16120 “Wire, Cables and Connectors”.

C. Tighten electrical connections and terminals according to manufacturer’s published torque-tightening values. If manufacturer’s torque values are not indicated, use those specified in UL 486A/B.

VII. FIELD QUALITY CONTROL

A. Perform the following field tests and inspections, and prepare test reports :

1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.

2. Test GFCI operation with both local and remote fault simulations according to manufacturer’s written instructions.

3. Test Instruments: Use instruments that comply with UL 1436.

4. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.

2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.

3. Ground Impedance: Values of up to 2 ohms are acceptable.

4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.

5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Remove malfunctioning units, replace with new units, and retest as hereinbefore specified.

END OF SECTION

Part 1 - General

I. SUMMARY

A. Related Documents:

1. Drawings and general provisions of the Subcontract apply to this Section.

2. Review these documents for coordination with additional requirements and information that apply to work under this Section.

B. Section Includes:

1. This section specifies the unique responsibilities that are a part of, or are related to the commissioning process for the electrical systems. Electrical systems include those listed in Division 01 Section "General Commissioning Requirements" as being commissioned. All statements are the responsibility of the Subcontractor, unless specifically stated otherwise.

2. Electrical testing specified for systems not listed as formally commissioned are not under the commissioning umbrella and are not governed by this section.

3. Electrical Systems Commissioning consists of static checks of component and system installations and actual testing of equipment conditions and functions.

4. The Commissioning Authority or University will review and approve, prior to use, all test procedures and forms used and will witness a varying fraction of the initial checks and testing performed by the Subcontractor. The Commissioning Authority will review the completed check and test documentation of the Subcontractor of all checks and tests.

5. Electrical testing requirements are found in various sections in Division 01 and in Division 26 (Division 01 Section "General Commissioning Requirements" and this section). It is not the intent of the commissioning process or these specifications to duplicate efforts or to require the Subcontractor to perform any check or test twice. Checks and testing by the Subcontractor are expected to occur once in the normal sequence of installation and checkout, if appropriate coordination has occurred allowing the University and the Commissioning Authority to witness installations and initial testing. Identical electrical checks and testing requirements in both Division 01 and Division 26 are referring to the same event.

6. The test requirements listed in this section do not release the Subcontractor from the obligation to perform all other appropriate, industry standard, manufacturer-recommended or code-required checks and tests.

7. Testing Participants. The work of this section shall be performed by parties identified in the Check and Testing Responsibility Table--a supplement to Division 01 Section "General Commissioning Requirements". Static checks and testing shall be fully documented according to provisions in Division 01 Section "General Commissioning Requirements".

C. Related Sections:

1. Division 01 Section "General Requirements."

2. Division 01 Section "Special Procedures."

3. Division 01 Section "General Commissioning Requirements".

II. SUBMITTALS

A. Submit under provisions of Divisions 01 Section "General Requirements" and "Special Procedures."

III. QUALITY ASSURANCE

A. Qualifications:

1. The CTC (Certified Testing Company) performing the work of this section shall be qualified to test electrical equipment and is a NETA (National Electrical Testing Association)-certified testing agency. The CTC shall not be associated with the manufacturer of equipment or systems under test.

B. Test Equipment:

1. The Subcontractor shall provide all test equipment necessary to fulfill the checks and testing requirements. Test equipment shall have been calibrated within one (1) year of its use on the project.

C. Refer to Division 01 Section "General Commissioning Requirements" for additional requirements.

Part 2 - Products -- NOT USED

Part 3 - Execution

I. SUBMITTALS

A. Sixty (60) days before any testing is conducted, submit an overall testing plan and schedule for electrical systems that lists the equipment, modes to be tested, dates of

testing and parties conducting the tests. Put these tests into the master construction schedule. Keep this plan and schedule updated.

B. Additional submittal requirements relative to commissioning are found in this Section and in Division 01 Section "General Commissioning Requirements" and Division 01 Section "General Requirements."

II. COMMON RESPONSIBILITIES

A. The following are responsibilities applicable to all electrical systems being commissioned.

B. The general commissioning requirements and coordination are detailed in Division 01 Section "General Commissioning Requirements" and apply to electrical systems. The Subcontractor shall be familiar with all parts of Division 01 Section "General Commissioning Requirements" and the commissioning plan issued by the Commissioning Authority and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

C. The work of this Section shall be performed by a CTC (Certified Testing Company, Electrical), by the EC (Electrical Subcontractor), or the MSR (Manufacturer's Service Representative). The Commissioning Authority has some testing responsibilities for some equipment. The specified checks and static tests are conducted by any of the above listed parties, but the tests requiring measurements or special tools or skills are generally conducted only by the CTC. The Check and Testing Responsibility Table, included as a supplement to Division 01 Section "General Commissioning Requirements" provides specific allocation of checklist oversight and testing responsibilities. The CTC, EC, and MSR shall document all checks and testing on check and test procedure forms submitted to and approved by the Commissioning Authority prior to testing.

D. The Subcontractor shall notify PGCPS ahead of time when commissioning activities not yet performed or not yet scheduled will delay construction. The Subcontractor shall be proactive in seeing that commissioning processes are executed and that the CA has the scheduling information needed to efficiently execute the commissioning process.

E. The Subcontractor shall respond to notices of issues identified during the commissioning process, making required corrections or clarifications and returning prompt notification to the Commissioning Authority according to the process given in Division 01 Section "General Commissioning Requirements".

F. When completion of a task or other issue has been identified as holding up any commissioning process, particularly functional testing, the Subcontractor shall, within two (2) days of notification of the issue, notify the Commissioning Authority in writing providing an expected date of completion. The Subcontractor shall notify the Commissioning Authority in writing within one day of completion. It is not the responsibility of the Commissioning Authority to obtain this status information through meeting attendance, asking questions or field observation

G. Construction Checklists. The Commissioning Authority or Subcontractor shall develop checklists as noted in the list of commissioned systems in Division 01 Section "General Commissioning Requirements", following the process described in Division 01 Section "General Commissioning Requirements" and in this Section. At a minimum, for a given piece of equipment, checks from the inspection checklists in NETA Acceptance Testing Specifications for Electric Power Distribution Equipment and Systems shall be included in the electrical checklists. The Subcontractor shall execute and document all checks.

H. Check and testing procedure and startup plan development and execution responsibilities are described in the Check and Testing Responsibility Table in the supplements to Division 01 Section "General Commissioning Requirements".

I. The Subcontractor shall review design documents, shop drawings and O&M manuals and manufacturer recommended installation and testing procedures of each system installation.

J. The Subcontractor shall monitor installation to ensure the equipment, configuration and quality of construction meets the design requirements, approved submittals and shop drawings.

K. The Subcontractor shall develop test procedures and forms and execute and document testing according to the requirements of this Section, Division 01 Section "General Commissioning Requirements" and other specification sections containing testing requirements.

L. Tests of energized equipment shall be conducted when the equipment is operating at its normal capacity. This may require some tests to be conducted after occupancy.

M. Training and Orientation. The Subcontractor shall follow the facility staff orientation and training requirements as described in Division 01 Section "Demonstration and Training" and other applicable technical sections.

N. Operation And Maintenance (O&M) Manuals. Refer to Division 01 Section "General Commissioning Requirements" and Division 01 Section "General Requirements" for requirements for O&M manuals.

Part 4 - Equipment Specific Verification and Testing Requirements

III. SUMMARY

A. This Part specifies the check and testing requirements for electrical components and systems. From these requirements, the Commissioning Authority or Subcontractor will develop detailed procedures and forms. The general testing process, requirements and test method definitions are described in Division 01 Section "General Commissioning Requirements".

IV. CHECKS AND TESTS

A. Checks are intended to begin upon completion of a component or equipment installation. Testing generally occurs later when systems are energized or nearing that point. Beginning system testing before full completion, does not relieve the Subcontractor from fully completing the system as soon as possible, including all construction checklists and may require retesting portions of the system once all components are fully functioning.

B. Refer to Division 01 Section "General Commissioning Requirements" for specific details on non-conformance issues relating to construction checklists and tests. Refer to Division 01 Section "General Commissioning Requirements", for common requirements of deferred testing and to articles in this Section.

C. The check and test procedures and record forms shall contain the following:

1. The Subcontractors executing the checks or tests.

2. A list of the integral components being inspected and tested, equipment tag numbers, manufacturer, model number, pertinent performance information / rating data.

3. Test equipment used.

4. Construction checklists associated with the components, if any.

5. Any special required conditions of the check or test for each procedure.

6. Items, conditions or functions to be inspected, verified or tested, the checks and testing method given and a place provided with results recorded.

7. Acceptance criteria (or reference by specific table where the acceptance criteria is found).

8. For each procedure, list the technician performing check or test and company, witnesses of the tests and dates of tests.

9. Sampling strategies used.

D. The test procedures for dynamic equipment like lighting controls, emergency generator or fire alarm shall contain more step-by-step procedures with expected responses similar to the sample test provided as a supplement to Division 01 Section "General Commissioning Requirements". The test procedures and forms for more static components like panel boards, switchgear, circuit breakers, transformers, etc., can be more checklist-like in format. For each piece of equipment, checks and test procedures and their documentation record forms may be different documents or combined in the

same document, but checks and tests should be grouped.

E. At the Commissioning Authority's discretion, if large numbers or repeated deficiencies are encountered, the Subcontractor shall test and troubleshoot all remaining systems at issue on their own before commissioning with the Commissioning Authority will resume.

F. Sampling for Identical Units. When there are a number of identical units, at the Commissioning Authority's discretion, some or all procedures of a test for a piece of equipment or assembly may be omitted when these same tests on other pieces of identical equipment or assemblies were conducted without deficiency.

V. EQUIPMENT-SPECIFIC TESTING REQUIREMENTS

A. The following paragraphs define the testing requirements for each type of system or feature that is a part of the project. The Commissioning Authority shall use this information to develop specific testing procedures for each of the systems to be commissioned. The Subcontractor shall be responsible for support, execution and coordination of these tests as described in the project specifications including intersystem tests and interlocks with systems in Divisions other than Division 26.

B. The Commissioning Authority and Subcontractor shall coordinate with the project LEED coordinator to verify that LEED requirements for testing electrical systems are included in the tests.

C. Common Testing Requirements

1. The following requirements apply to all electrical systems and features that are to be commissioned when referenced below. Tests shall:

a) Verify functionality and compliance with the design intent for each individual sequence module in the sequences of operation. Verify proper operation of all control strategies, energy efficiency and self-diagnostics features by stepping through each sequence and documenting equipment and system performance. Test every step in every written sequence and other significant modes, sequences and operational features not mentioned in written sequences; including startup, normal operation, shutdown, scheduled on and off, unoccupied and manual modes, safeties, alarms, over-rides, lockouts and power failure.

b) Verify all alarm and high and low limit functions and messages generated on all points with alarm settings.

c) Verify integrated performance of all components and control system components, including all interlocks and interactions with other equipment and systems.

d) Verify shut down and restart capabilities both for scheduled and unscheduled events (e.g. power failure recovery and normal scheduled start/stop).

e) When applicable, demonstrate a full cycle from off to on and no load to full load and then to no load and off.

f) Verify time of day schedules and setpoints.

g) Verify all energy saving control strategies.

h) Verify that monitoring system graphics are representative of the systems and that all points and control elements are in the same location on the graphic as they are in the field.

i) Provide complete and accurate equipment labeling for the operations and maintenance staff. The equipment labels listed on the drawings and sequences of operation should match the field labels and should be verified as a part of the commissioning process.

j) Verify operator control of all commandable control system points including proper security level access.

k) When testing procedures for commissioned equipment are listed in NETA Acceptance Testing Specifications for Electric Power Distribution Equipment and Systems the NETA test procedures shall be part of the testing requirements of this specification. Additional testing procedures may be listed in this specification.

l) Common Acceptance Criteria

2. The following common acceptance criteria apply to all mechanical equipment, assemblies and features:

a) For the conditions, sequences and modes tested, the equipment, integral components and related equipment shall respond to varying loads and changing conditions and parameters appropriately as expected, according to the sequences of operation, as specified, according to acceptable operating practice and the manufacturer's performance specifications. Verify that equipment operates within tolerances specified in: governing codes, acceptance criteria contained in the construction documents, manufacturer's literature and according to good operating practice.

b) Systems shall accomplish their intended function and performance.

c) All safety trips shall require a manual reset to allow a system restart.

d) Resetting a manual safety shall result in a stable, safe, and predictable return to normal operation by the system.

e) Safety circuits and permissive control circuits shall function in all possible combinations of selector switch positions (hand, auto, inverter, bypass, etc.).

f) Other acceptance criteria is given in the equipment testing requirements articles or referenced standards.

g) Additional acceptance criteria will be developed by the Commissioning Authority when detailed test procedures are developed.

h) When testing procedures for commissioned equipment are listed in NETA Acceptance Testing Specifications for Electric Power Distribution Equipment and Systems the NETA performance criteria shall apply.

D. Equipment-Specific Testing Requirements:

1. Scheduled Lighting Controls.

a) Apply the applicable common testing requirements and acceptance criteria.

b) Test Methods. Utilize active testing, and trending when available. If able to trend, trend all zones over a week period and follow the trending guidelines in Division 15 Section "Commissioning of HVAC".

c) Sampling Strategy. Manually test 20 percent of the zones or at least four. If more than 10 percent or two zones fail, test another 10 percent sample. If the second sample fails the Subcontractor shall document retesting on all zones on their own using a Commissioning Authority approved form.

2. Occupancy Sensor Lighting Controls.

a) Apply applicable common testing requirements and acceptance criteria. Test all units functions, including sensor sensitivity and time-to-OFF functions and ensure that sensor location is proper and won't be tripped inadvertently by other occupants and movements outdoors, etc...

b) Ensure that the sensor is correctly placed and oriented per the specifications and/or construction drawings. If unanticipated obstructions are present, it may be necessary to adjust the sensor location and

orientation.

c) Adjust the sensitivity and time delay of the occupancy sensor, and test to ensure it provides appropriate response. For optimal user acceptance, energy savings and lamp life, set the time delay initially for a minimum of 15 minutes (NEMA recommendation).

d) Daylight Harvesting - All furnishings and interior finishes and materials should be installed before calibrating the sensors. Adjust the photosensor to determine the threshold for switching based on detected light level. It may be helpful to calibrate under normal daylight conditions and dusk conditions (it may be possible to close window blinds to approximate dusk). Record the calibration adjustments, if possible, and replicate in similar spac

e) Test Methods. Utilize active test methods.

3. *Time Delay:* The time delay setting indicates how much time it will take to shut off the lights after detecting that the space is unoccupied.

4. Motion Sensitivity: The occupancy sensor's motion sensitivity level indicates how much movement causes the lights to turn on.

5. *Entry Test:* If the sensor is used to automatically turn on the lighting, then it should do so within two seconds after the person gets three feet into the space.

6. *Perimeter Test:* Walk and wave your hand in different places around the room to try to find spots where the sensor is least effective in detecting major and minor motion.

a) Sampling Strategy. Test 10 percent of the sensors or six, whichever is greater. If more than 10 percent or two sensors fail, test another 10 percent sample. If the second sample fails the Subcontractor shall document retesting on all units on their own using a Commissioning Authority approved form.

b) Additional Acceptance Criteria. Reasonable sensitivity, no inadvertent trips, lights go off within 15 seconds of design.

7. Emergency Generator System

a) Apply applicable common testing requirements and acceptance criteria.

b) Simulate a utility power outage to verify the essential power system restores power to essential loads.

8. Power to the loads connected to the life safety system within 10 seconds of a utility outage.

    a) Test according to NETA 7.22.1 and NFPA 110 5.13 and per Division 01 Section "Special Procedures."

    b) Record all data and results.

    c) Include the following tests:

        (1) When in enclosed spaces, verify combustion and ventilation air damper functions and pressure drop of exhaust.

        (2) Verify fuel oil system, diesel fuel storage tank, and level and low fuel indication alarms.

        (3) Verify all alarms, meters, and auxiliaries and interlocks to the BAS.

    d) Building Test. Under a cold generator condition, provide full utility power interruption under load and cause emergency power service operation. Include all UPS in this test. Load bank the UPS if necessary during test.

    e) Verify all generator functions

    f) Test auto-transfer switch operation under actual voltage drop, per specification Division 26 Section "Automatic Transfer Switch with Bypass-Isolation Feature".

    g) Using a power line disturbance monitor, measure the following times: power failure to engine start command, engine start command to engine start (cranking time), engine start to point where generator is at proper volts and frequency and total time from power failure until ATS switches.

    h) Verify system reporting & control monitoring point-to-point

    i) Verify that each circuit and equipment served by emergency power, does power up. Verify all functions of the Emergency Power Response Matrix.

    j) Verify appropriate mechanical system and control system restart functions of all equipment served by the generator.

    k) Neutral Bonding - If a 4 pole ATS is used, the neutral should be bonded at the generator or paralleling switchgear. If a 3 pole ATS is used, the neutral should not be bonded at the generator or paralleling switchgear. In both cases the neutral is bonded at the service entrance.

l) Testing of Incoming power and distribution equipment should occur prior to energization of this equipment.

m) The commissioning professional shall request the settings for ATS's and other equipment well in advance of functional performance testing. Verify that the settings are correctly applied in the field.

n) Provide complete and accurate equipment labeling for the operations and maintenance staff. The equipment labels listed on the drawings and sequences of operation should match the field labels and should be verified as a part of the commissioning process.

9. Step Load Tests.

a) Test at 0 percent, 25 percent, 50 percent and 100 percent of full load. Measure voltage and frequency and record all gaged engine conditions. The test shall consist of running the the engine-generator while connected to the resistive load bank for one hour, and then shutting down for 30 minutes.

b) Test for multiple generator starts.

c) Verify all operational data and start-up minimum time interval.

d) Verify 2-hour full load run full load bank (building load can serve as part of the load).

e) Verify all generator-running characteristics.

f) Verify battery-charging system.

10. Uninterruptible Power Supply.

a) Apply applicable common testing requirements and acceptance criteria.

b) Test according to NETA 7.22.2 and NFPA 111-2001 5.6.

c) Test the UPS during the Integrated Building Test in the Emergency Generator System test requirements article in this Section.

11. Fire Alarm.

a) Apply applicable common testing requirements and acceptance criteria.

12. NFPA 3: Recommended Practice for Commissioning of Fire Protection and Life

Safety Systems and NFPA 4: Standard for Integrated Fire Protection and Life Safety System Testing.

13. Hire a company or person who has qualifications of both fire alarm commissioning and integrated testing to confirm that the Fire alarm system interacts properly with other systems.

    a) Test the fire alarm and High Sensitivity Smoke Detection systems according to NFPA 110-1999 7-1 through 7-2, and specification Division 28 Sections "High Sensitivity Air Sampling Smoke Detection System" and "MXL Fire Detection & Alarm System".

    b) Document all test procedures and results. A fire alarms system printout of the test annunciation record is not sufficient documentation.

    c) Verify all fire alarm panel functions, alarms and troubles.

    d) Verify all functions in the Fire Alarm Response Matrix, including remote communications.

    e) Verify resetting of all equipment affected by an alarm.

    f) Sampling Strategy. Verify device functions and annunciations per using the approved sampling rate of the authority having jurisdiction and per LBNL.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered in this section shall include furnishing and installing complete lighting control systems for the control of selected interior and exterior lighting and other equipment as indicated on the Drawings, detailed in the manufacturer submittal and as further defined herein. Contractor is solely responsible to verify quantity, installation locations and wiring requirements for this project. Specific manufacturers' catalog numbers, when listed in this section are for reference only. It is the responsibility of this Contractor to verify with the lighting control manufacturer all catalog information and specific product acceptability.

B. The systems shall include but not be limited by the following: Pre-wired, microprocessor controlled relay panels with electrically held, electronically latched relay panels controlled via communication based equipment including digital switches, digital photocells, Digital Time Clock (DTC), other various digital devices, interface cards, occupancy sensors and other devices as shown on the Drawings. The type of lighting control equipment and wiring specified in this section is covered by the description: Microprocessor Controlled Digital Relay Lighting Control system with RS485 Bus communications.

C. Requirements are indicated elsewhere in these specifications for work including, but not limited to, raceways and electrical boxes and fittings required for installation of control equipment and wiring.

D. It is the intent of this specification that the entire lighting control system, as specified herein, be available to all bidders and not "Packaged or Bundled" with any other lighting systems or equipment. Therefore, the lighting control system shall be provided as a separate price, to all bidders, at bid time.

III. DEFINITIONS

A. BACnet: A networking communication protocol that complies with ASHRAE 135.

B. BAS: Building automation system

C. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling and power-limited circuits.

D. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.

E. RS-485: A serial network protocol, similar to RS-232, complying with TIA/EIA-485-A

IV. 1.2 SUBMITTALS

A. Product Data: For control modules, power distribution components, manual switches and plates, and conductors and cables.

B. Shop Drawings: Detail assemblies of standard components, custom assembled for specific application on this Project.

1. Outline Drawings: Indicate dimensions, weights, arrangement of components, and clearance and access requirements.

2. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.

3. Wiring Diagrams: Power, signal, and control wiring. Coordinate nomenclature and presentation with a block diagram.

C. Coordination Drawings: Submit evidence that lighting controls are compatible with connected monitoring and control devices and systems specified in other Sections.

1. Show interconnecting signal and control wiring and interfacing devices that prove compatibility of inputs and outputs.

2. Field quality-control test reports.

D. Operation and Maintenance Data: For lighting controls to include in emergency, operation, and maintenance manuals.

V. QUALITY ASSURANCE

A. Source Limitations: Obtain lighting control module and power distribution components through one source from a single manufacturer.

B. The lighting control systems shall meet the requirements of the National Electrical Code (NEC), state and local codes, and these Specifications.

C. Lighting Control Panels (LCP) shall be UL 916 Listed. LCPs controlling emergency operation by a relay panel shall fully comply with NEC 700.9(B). This Contractor is responsible for verifying compliance.

D. Control wiring shall be in accordance with the NEC requirements for Class 2 remote control systems, Article 725 and manufacturer’s specification and requirements.

E. Comply with protocol described in IEC 60929, Annex E, for DALI lighting control

devices, wiring, and computer hardware and software.

VI. SUBMITTALS

A. This Contractor shall furnish submittals for all components of the lighting control systems in accordance with SECTION 260500 of these Specifications. Submittals shall include the following for review. Submittals not containing all of the information listed below will be rejected.

1. Shop Drawings: Submit dimensioned drawings of complete lighting control systems and accessories including, but not necessarily limited to, relay panels, switches, DTC, photocells and other interfaces. Shop drawings shall indicate exact location of each device. Plans shall be diagrammatical. “Cut Sheet” submittals not acceptable. This contractor shall furnish to the lighting control system manufacturer a copy of the project construction phasing plan for design of the bus system.

2. Product Data: Submit for approval manufacturer’s data on the specific lighting control systems and components. Submittal shall be in both electronic and hard copy formats. To prevent departures from approved system operation, electronic file submitted shall be able to be directly downloaded to the specified system at the manufacturer’s facility. Submit a complete bill of materials with part numbers, description and voltage specifications.

3. One Line Diagram: Submit a one-line diagram of the system configuration indicating the type, size and number of conductors between each component, and each communication buss provided for the project. Submittals that show typical riser diagrams are not acceptable.

4. Programming Forms: Submit programming forms with complete information describing the operation of the lighting control system and all other information necessary to show proper operation of the system.

VII. COORDINATION

A. Coordinate lighting control components to form an integrated interconnection of compatible components.

1. Match components and interconnections for optimum performance of lighting control functions.

B. Coordinate lighting control components specified in this Section with components specified in Section 16435 "Branch Circuit Panelboards.

VIII. SPARE PARTS

A. Provide 10% spare relays per Lighting Control Panel, up to the maximum capacity of the LCP. If the LCP is fully populated with active relays provide a minimum of two spare relays, per relay panel.

B. Provide a ten (10) spare classroom lighting control switches plus one (1) spare digital switch for each additional type of digital switch shown.

C. Provide CD version of manufacturer's operating software to include graphical interface software. Software shall be the latest version.

D. Provide 2 extra sets of as-built and operating manuals.

E. Provide 10 spare keys for each key operated switch.

IX. SYSTEM DESCRIPTION

A. The lighting control system shall be a networked system that communicates via RS485. The systems must be able to communicate with fully digital centralized relay panels, micro relay panels, digital switches, photocells, various interfaces and shall include all operational software. Relay panels shall control selected interior and exterior lighting and site lighting. Lighting control system shall include all hardware and software. Software shall be resident within the Digital Time Clock (DTC). System shall provide local access to all programming functions via Ethernet connection.

B. System software shall provide real time status of each relay, each zone and each group.

C. Lighting control systems shall be able to be monitored by and take commands from a remote PC. At any time, should the remote PC go off-line all system programming uploaded to the lighting control system shall continue to operate as intended. Systems requiring an on-line PC or server for normal operation are not acceptable.

D. All devices shall be pre-addressed at the factory. Field addressing is not acceptable.

E. All programs, schedules, time of day, etc., shall be held in non-volatile memory for a minimum of 10 years at power failure. At restoration of power, lighting control system shall implement programs required by current time and date.

F. System shall be capable of flashing lights Off/On any relay or any zone prior to the lights being turned Off. The warning interval time between the flash and the final lights off signal shall be definable for each zone. Occupant shall be able to override any scheduled Off sweep using local wall switches within the occupied space. Occupant override time shall be locally and remotely programmable and not exceed 2-hours.

G. System shall be capable of implementing on commands, Off commands, Raise (dimming) commands, Lower (dimming) commands for any relay, group or zone by means of digital wall switches, specification grade line voltage type wall switches, photocell, web based software or other devices connected to programmable inputs in a lighting control panel.

H. The lighting control system shall provide the ability to control each relay and each relay group per this specifications requirement. All programming and scheduling shall be able to be done locally at the Master LCP and remotely Text Deleted via the internet. Remote connection to the lighting control system shall provide real time control and real

time feedback.

I. System may consist of centralized relay panels, micro relay panels, digital switches, photocells, various digital devices and various digital interfaces. Centralized relay panels and digital switches shall communicate as one network via RS485.

J. Micro relay panels shall be capable of taking inputs from standard, line voltage type switches and outputting up to eight (8) independent 0v to10v dimming signals. All micro relay panels and devices connected to the relay panels (switches, photocells, occupancy sensors, etc.) shall be wired per lighting control manufacturer's instructions.

K. 4 thru 16 relay panels shall be available that contain field configurable relays. Panels shall include (4) inputs for photosensors, (4) inputs for occupancy sensors and (4) dry contact inputs. One 0-10V dimming output shall be available per relay.

X. SYSTEM TEST AND ACCEPTANCE

A. Prior to the Architect/Engineer's final site visitation, and acceptance of each construction phase, this Contractor shall conduct a complete operating test of each system including each device. The systems shall test free from grounds, shorts, and other faults. All connections shall be thoroughly checked for mechanical and electrical connection. All equipment shall be demonstrated to operate in accordance with the requirements set forth in these Specifications and as shown on the Drawings.

B. This Contractor shall perform all tests in the presence of the Owner. This Contractor shall furnish all personnel for use in the tests.

C. When the work on the system has been completed and is ready for final review, a visit shall be made by the Owner at which time the Contractor shall demonstrate that the requirements of the Contract as it applies to this system have been carried out and that the system has been adjusted and operated in accordance herewith.

XI. DOCUMENTATION

A. This Contractor shall furnish to the Owner point-to-point "As Built" wiring diagrams for the lighting control systems. Diagrams must indicate exact mounting location of each system and their devices. This accurate "as built" shall indicate the loads controlled by each relay and the identification number for that relay, placement of switches and location of photocell. Original shall be given to Owner, copies placed inside the door of each LCP.

B. This Contractor shall furnish to the Owner, four (4) sets of factory operation and maintenance manuals. These manuals shall include factory service manuals with complete parts lists, wiring and component schematics including circuit diagrams, programming forms with complete information and all other information necessary for the proper operation, service, and maintenance of the Lighting Control Systems.

XII. TRAINING

A. This Contractor shall furnish four (4) hours of technical service training to the Owner's

technical staff using the factory operation manuals previously specified.

B. This Contractor shall furnish four (4) hours of operating and programming training to the Owner's operating staff to be scheduled at the Owner's convenience during the warranty period.

C. All training specified herein shall be performed by a factory certified technician.

XIII. WARRANTY

A. This Contractor shall deliver the work in first-class operating condition in every respect. This Contractor shall also warrant that the material, equipment, and workmanship furnished shall be entirely free from defects. Any materials, equipment, or workmanship in which defects may develop before or during the warranty period shall be repaired or replaced at the Contractors own expense. Refer to SECTION 01740 for the start of the warranty period. This contractor shall further warrant that all material, equipment, and workmanship used in the installation, but not specifically mentioned in the Drawings and Specifications, is the best of their respective kinds and that the construction and installation was performed in accordance with the best accepted standard practices in all details.

Part 2 - Products

I. MANUFACTURER

A. Lighting Control Systems products shall be manufactured by Lighting Control & Design (LC&D), Los Angeles, CA, 800.345.4448 or as listed herein by Eaton Cooper (Elementary Schools Only) Controls. Such firms shall be regularly engaged in the manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years. Any product or manufacturer other than those listed in this specification must be pre-approved in accordance with these specifications as hereinbefore described in SECTION 16010. Engineer to Edit.

II. SYSTEM REQUIREMENTS

A. Expandability: System shall be capable of increasing the number of control functions in the future by 25 percent of current capacity; to include equipment ratings, housing capacities, spare relays, terminals, number of conductors in control cables, and control software.

B. Performance Requirements: Manual switch operation sends a signal to programmable-system control module that processes the signal according to its programming and routes an open or close command to one or more relays in the power-supply circuits to groups of lighting fixtures or other loads.

III. MATERIAL AND COMPONENTS

A. Relay panels shall be LC&D GR1400 LTD series (Blue Box LTD), GR2400 series Relay

Panel, GR2400i series MicroPanel or GR2400 MicroPanel-8. Relay panels shall have the quantities of single pole and two pole relays and spares, devices and accessories required to perform the lighting control functions described herein and shown on the Drawings.

1. The enclosure(s) shall be NEMA 1 rated with a hinged door cover with a keyed lock, except MicroPanels may have a screwed cover. A 16-gauge steel barrier shall separate the high voltage and low voltage compartments of the panel and separate 120 volts and 277 volts.

2. LCP input power shall be capable of accepting 120 volt or 277 volt without rewiring.

3. Control electronics in the low voltage section shall be capable of driving two (2) to forty-eight (48), 30 ampere, 18,000 SCCR rated latching relays, control any individual or group of relays, provide individual relay overrides, provide a master override for each panel, store all programming in non-volatile memory, after power is restored return system to current state, provide programmable blink warn timers for each relay and every zone, and be able to control relays that default to Open, Normally Open Latching (NOL) or relays that default to Closed, Normally Closed Latching (NCL).

4. Lighting control systems shall be digital and may consist of a Master LCP, Slave LCPs, Micro LCPs, digital switches, photocells and digital interface cards of the quantities necessary to perform the functions shown on the Drawings. All system components shall connect and be controlled via a single Category 5e, 4 twisted pair cable with RJ45 connectors, providing real time two-way communication with each system component. All Micro LCPs shall provide multiple quick connect inputs for photocells and occupancy sensors. Analog systems are not acceptable.

B. Micro Relay Panels

1. Micro relay panels shall have 8, 30a, 18,000 SCCR rated lighting relays and shall control all lighting in the designated area indicated on the plans and be part of the lighting control network. Each micro relay panel shall provide minimum 300ma at 24vdc for powering occupancy sensors. Micro relay panels that require a separate occupancy sensor power pack are not acceptable.

2. Micro relay panel shall provide a minimum 4-programmable photocell inputs, a minimum 4-programmable occupancy sensor inputs and matrixed contact closure inputs. This requirement is to insure integration of entire lighting system into one networked, lighting control system.

3. Micro relay panels shall be capable of outputting minimum 4 and up to 8 independent 0v to 10v dimming signals, one independent dimming signal at each of 8 relays. In order to maximize daylight harvesting and minimize disruption to occupants, each dimming output shall provide adjustment for baseline, start point, mid-point, end point, trim, fade up rate, fade down rate, time delay and enable/disable masking. Any 2 individual relays shall be able to

be “bound” to dim as one continuous load. (Relay 1 dims from 100% to 0%, then relay 2 starts dimming from 100% to 0%) All photocell setting must be remotely accessible. Systems providing On, Off with Time Delay only, and system that do not provide remote access are not acceptable.

C. BlueBox LTD Panels

1. BlueBox LTD panels shall contain 4, 8 or 16 field configurable relays as indicated on the plans and be part of the lighting control network. Each BlueBox LTD panel shall provide 300mA at 24VDC for powering occupancy sensors.

2. BlueBox LTC panels shall provide 4-programmable photocell inputs, 4-programmable occupancy sensors inputs and 4-programmable contact closure inputs. All inputs shall be able to be matrixed to any relay in the panel.

3. BlueBox LTD panels shall be capable of outputting a quantity of 0-10V dimming signals equivalent to the number of relays in the panel. In order to maximize daylight harvesting and minimize disruption to occupants, each dimming output shall provide adjustment for baseline, start point, mid-point, end point, trim, fade up rate, fade down rate, time delay and enable/disable masking. Any 2 individual relays shall be able to be “bound” to dim as one continuous load. (Relay 1 dims from 100% to 0%, then relay 2 starts dimming from 100% to 0%) All photocell setting must be remotely accessible. Systems providing On, Off with Time Delay only, and system that do not provide remote access are not acceptable.

D. Standard Output Relays

1. UL listed 30 Amp, Latching, 18,000 SCCR, 277VAC Ballast and HID and 20 Amp Tungsten at 120 VAC.

2. Relays shall be individually replaceable. Relay terminal blocks shall be capable of accepting two (2) #8 AWG wires on both the line and the load side. Systems that do not allow for individual relay replacement or additions are not acceptable.

3. Relays shall be rated for 250,000 operations minimum at a full 30 ampere lighting load, default to closed at normal power loss, Normally Closed Latching (NCL).

4. Other relay types may include: Normally Open Latching (NOL) relay rated for 250,000 operations; a 600 volt 2-pole NO and NC; and a Single Pole, Double Throw (SPDT) relay, as appropriate for the application of this project.

5. Each relay shall have an identification label indicating the originating branch circuit number and panelboard name as indicated on the Drawings. This identification may be in the form of a schedule or directory affixed on the inside door of the panel. Each line side branch circuit conductor shall have an identification tag indicating the branch circuit number.

6. Relays shall be manufactured to default to closed (simulated NC) upon loss of power, unless otherwise noted.

E. Field Configurable Relays (BlueBox LTD only)

1. UL Listed 40A, Latching, 65,000A SCCR (maximum), controlling 120VAC to 480VAC (in multi-pole configuration).

2. Relays shall be individually replaceable. Relay terminals shall be capable of accepting two (2) #8 AWG wires on both the line and the load side.

3. Relays shall have a manual override switch that allows the opening and closing of the relays when the system is not energized.

4. Relays shall be field-configurable into single-, double- and triple-pole configurations through the use of a handle-tie.

5. Relays shall be rated for 250,000 operations minimum at full load and default to normally-closed at the loss of normal power.

6. Each relay shall have an identification label indicating the originating branch circuit number and panelboard name as indicated on the Drawings. This identification may be in the form of a schedule or directory affixed on the inside door of the panel. Each line side branch circuit conductor shall have an identification tag indicating the branch circuit number.

F. Low Voltage Switches

1. All switches shall be digital and communicate via RS485. Contact closure style switches, except as specified for connection to the micro relay panel matrixed contact closure inputs, shall not be acceptable. The programming for a digital switch will reside in the switch itself, via double EPROM memory. Any digital switch button function shall be able to be changed locally (at DTC or a PC) or remotely, via Internet or Ethernet.

2. Digital low voltage switch shall be a device that sits on the lighting control system bus. Digital switch shall connect to the system bus using the same cable and connection method required for relay panels. System shall provide capability to locally and remotely program each individual switch button, monitor and change function of each button locally and remotely. Each button shall be capable of being programmed for On only, Off only, On/Off (toggle), Raise (Dim up) and Lower (Dim down). Switches requiring low voltage control wires to be moved from one input terminal to another to accomplish these functions are not acceptable.

3. Digital low voltage switch buttons shall have custom factory engraving (and filled) as shown on the Drawings. Engraving shall be up to two (2) lines and up to eight (8) characters per line, minimum. Buttons colors shall be white or ivory unless other colors are shown on the Drawings.

4. Keyed switches shall be programmable and connect to the lighting controls system bus.

5. Where indicated on the Drawings, digital switches shall be high abuse vandal resistant, contain no moving parts, and be touch sensitive and available with up to three buttons in a single gang. Multi gang versions shall also be available. Touch pads shall be Stainless Steel and capable of handling both high abuse and wash down locations. High abuse switches shall connect to the lighting control system digital bus. Each high abuse switch touch button shall be able to control any relay or any group in any panel or panels that is part of the lighting control system. Each touch button shall be able to be programmed for On, Off, Toggle or Maintain operation. All programming shall be done locally or remotely Text Deleted or web interface as described in other paragraphs of this section. High abuse switches shall be able to be enabled or disabled digitally. Each touch pad is to be identified as to function by an engraved and filled label. Switches must be capable of handling electrostatic discharges of at least 30,000 volts (1cmspark) without any interruption or failure in operation.

G. DTC – Digital Electronic Time Clock

1. A Digital Time Clock (DTC) shall control and program the lighting control system and supply all time functions and accept interface inputs.

2. DTC shall be capable of up to 32 schedules. Each schedule shall consist of one set of On and Off times per day for each day of the week and for each of two holiday lists. The schedules shall apply to any individual relay or group of relays.

3. The DTC shall be capable of controlling up to 126 digital devices on a single bus and capable of interfacing digitally with other individual busses using manufacturer supplied interface cards.

4. The DTC shall accept control locally using built in button prompts and use of an 8 line 21-letter display or from a computer. All commands shall be in plain English. Help pages shall display on the DTC screen.

5. The DTC shall be run from non-volatile memory so that all system programming and real time clock functions are maintained for a minimum of 15 years with loss of power.

6. DTC shall provide system wide timed overrides. Any relay, group or zone that is overridden On, before or after hours, shall automatically be swept Off by the DTC a maximum of 2 hours later.

H. Remote Programming Connection

1. System shall be remotely programmable via an Ethernet connection that allows factory technicians to connect to the system. Provide all necessary software for local or remote control via Ethernet connection.

2. For single BUS systems, the system shall be provided with a Link-2- Ethernet connection. Link-2-Ethernet panel shall be provided with an Ethernet port for connection to the school's IT network.

3. For multiple BUS systems, the system shall be provided with an Uplink (one per BUS) and a MetaServer panel. MetaServer panel shall be provided with an Ethernet port for connection to the school's IT network.

I. Photocells: Photocells shall be mounted at locations indicated on the plans. Photocells used for exterior lights shall provide multiple trip points from 1 roof mounted or wall unit and shall be aimed north. All trip points shall be able to be changed remotely via internet or text deleted. Photocells requiring manual trip point adjustment are not acceptable. Photocell used for interior lighting control shall have multiple settings such as start-point, mid-point, off-point, fade-up, fade-down, etc. All settings shall be remotely accessible and adjustable. Systems providing local adjustment only are not acceptable. Photocells shall be certified to comply with the current energy code covering this project at time of submittal of plans for permit.

J. Interfaces: For expansion capability, the system shall have available all of the following interfaces. Verify and install only those interfaces indicated on the Drawings and/or necessary for the operation of the lighting control systems.

1. A dry contact input interface card that provides 14 programmable dry contact closure inputs. Use manufacturer's recommended cable to connect input devices to interface card.

2. Interface card providing digital communication from one system bus to another system bus, allowing up to 12,000 devices to communicate.

3. Direct digital interface to DMX 512 based systems. DMX interface shall provide 14 global commands, each of which can be modified locally or remotely using lighting controls manufacturer supplied software. DMX interface shall be integral to the system bus and shall connect and be controlled via a single Category 5, 4 twisted pair cable, providing real time response from the lighting control system to DMX commands.

4. Direct digital interface to building automation systems using DDC protocols such as BACnet, Metasys (N2) and ModBus that accept on/off commands, time schedules and report status of all relays in all panels in real time. Interface cards shall "self-populate" each individual relay and each group to the BAS. All BAS system programming required shall be the responsibility of the BAS system provider.

K. Graphical Interface: System shall have application specific graphical control software that allows the user to graphically locate and control any zone of lighting, indicating real time status. Following are required features:

1. Graphical interface shall have the capability of controlling 20 individual sites with up to 12 graphic screens per site and 1250 control points per graphic.

2. Software shall allow dwg, dwf, dxf, bmp, jpg and wmf files to be imported.

3. Each graphic screen shall be vector based and able to infinitely pan and zoom without any loss of graphic quality and allow for easy creation/editing of each control region.

4. Graphical software shall allow control of multiple buses over a single IP address via Server/Uplink backbone bus. Connection to PC via RS-232, or Ethernet.

5. Graphical software shall have embedded color pallet allowing individual color choices for all layers and control points.

6. Graphical software shall be password protected and allow direct access to DTC controller.

7. Software shall provide real time status (On/Off) for each relay and real time dimming output level.

L. Low Voltage Cable:

1. This Contractor shall furnish and install the required low voltage cable with RJ45 connectors between all switches and panels. The cable shall be UL listed, plenum rated, unshielded, four (4) twisted pairs, No. 24 AWG, Category 5e, extended distance, high speed data type with a flame retardant polyvinyl chloride jacket and a temperature range for dry locations of minus ten (10) degrees C to sixty (60) degrees C. A Category 5e cable, which meets this specification, is BERK-TEK Cat. No. 10033814 (Pink) or equal as manufactured by AMP, AT&T, BELDEN, THE CABLE COMPANY, GENISIS, HITACHI, MOHAWK, NORTHERN TELECOM, OPTICAL CABLE CORP., or PAIGE, or SUPERIOR.

2. Refer to Specification Section 16506 for low voltage three (3) conductor, No. 18 AWG, plenum rated wiring between Lighting Control Panels and occupancy sensors.

3. Low voltage wiring for connections to photocells and contact closure switches to Micro relay panels shall be three (3) conductors, No. 18 AWG, plenum rated with a temperature range for dry locations of minus ten (-10) degrees C to sixty (60) degrees C. A cable that will meet this specification is WEST PENN Cat. No. 25234B or equal by CONSULATED WIRE, GENERAL CABLE, PAIGE or TAPPAN.

Part 3 - Execution

I. EQUIPMENT INSTALLATION

A. Lighting Control Panels:

1. Before installing the lighting control panels relay control cabinets check all of the

Drawings for possible conflict of space and adjust the location of the relay control cabinet to prevent such conflict with other items. Relay control cabinet locations in electrical rooms and other spaces shall closely follow the layouts shown on the Drawings, leaving sufficient space on walls for future installations of panelboards and/or other electrical equipment.

2. Relay control cabinet shall be securely mounted to steel framing channels, by at least four (4) points, at locations shown on the Drawings. Construction shall be such that additional conduits can be added for future requirements.

3. The cabinets and enclosures shall be mounted and grounded in accordance with the NEC. This Contractor shall furnish all materials necessary for mounting the cabinets.

4. Relay control cabinets will generally be located adjacent to respective lighting panelboards unless otherwise shown on the Drawings. During the construction process, protect all interior components of each relay panel and each digital switch from dust and debris. Any damage done to electronic components due to non-protection shall be the sole responsibility of this Contractor.

5. Micro relay panels shown on the Drawings mounted in classrooms or similar spaces will generally be located above the ceiling either wall mounted or mounted to the building structure.

B. Switches: Provide outlet boxes, single or multi-gang, as shown on the Drawings for the low voltage digital switches. Provide Type 302 (non-magnetic) cover plates for all switches, refer to specification section 16130. Provide labeling as shown on the Drawings.

C. Wiring:

1. All vertical wiring for the lighting control systems shall be installed by this Contractor in conduit and/or surface metal raceway as shown on the drawings.

2. All horizontal wiring for the lighting control systems to be installed in areas without a ceiling or in areas without an accessible ceiling shall be installed by this Contractor in conduit sized for maximum 40% fill, but not less than ½" trade size.

3. All horizontal wiring for the lighting control systems to be installed in areas with accessible ceilings shall be installed by this Contractor and run exposed above the ceiling. Cables shall be supported by "J" hooks to be dedicated to the wiring specified in this specification section.

4. All horizontal wiring for the lighting control systems shall be run at right angles to the building structure.

5. All horizontal wiring for the lighting control systems shall be installed below the roof/floor structural supports (joists, beams, birders, etc.). Wiring installed between the structural supports mentioned above and the roof or floor deck will

not be acceptable.

6. All horizontal wiring penetrations for the lighting control systems through new and/or existing walls shall be sleeved. Minimum sleeve size shall be ¾ inch. All sleeves shall be bushed both sides.

7. All wiring for the lighting control systems in millwork or casework only shall be installed in flexible metal conduit, complete with an additional 200-pound pull string.

8. All wiring for the lighting control systems shall be furnished and installed by this Contractor as hereinbefore specified and as shown on the Drawings. All junction box covers shall be stenciled for distinct identification.

9. All low voltage RJ45 wiring connections shall be made by this Contractor as detailed on the Drawings using the 568A data only configuration. Lighting control system buss cables shall be continuous from the equipment enclosures to all other lighting control devices. The use of spices, “T” taps, or terminators in the buss wiring between devices is not acceptable.

10. All wiring shall be checked and tested by this Contractor to insure the system is free from grounds, opens, and shorts.

11. Do not mix low voltage and high voltage conductors in the same conduit.

12. Ensure low voltage conductors, conduits or control wires do not run within four (4) inches parallel to current carrying conduits or cables.

13. Place manufacturer supplied “terminators” at each end of the system bus per manufacturer’s instructions.

14. Neatly lace and rack wiring in cabinets.

15. Plug in Category 5e cable at the indicated RJ45 port provided at each lighting control device, per manufacturer’s instructions.

16. Do not exceed 4000 ft-wire length for each system bus.

17. All items on the bus shall be connected in sequence (daisy chained). Star and spur topologies are not acceptable.

18. Each construction phase of this project shall have its own separate communication bus.

II. INSTALLATION AND SET-UP

A. Verify that conduit for line voltage wires enters the panel in line voltage areas and conduit for low voltage control wires enters the panel on low-voltage areas. Refer to manufacturer’s plans and approved shop drawings for location of line and low-voltage areas. It is the responsibility of this Contractor to verify with the lighting control

manufacturer all catalog information and specific product acceptability.

B. For approved line voltage type Micro relay panel switches connected to matrixed inputs of the Micro relay panel, furnish #18 AWG conductors. For all other digital switches provide wiring required by the system manufacturer.

C. Contractor shall test all low voltage cable for integrity and proper operation.

D. Unused openings in the cabinets shall be effectively closed.

E. Lugs shall be suitable and listed for installation with the conductor being connected.

F. Neatly lace and rack wiring in cabinets. Conductor lengths shall be maintained to a minimum within the wiring gutter space. Conductors shall be long enough to reach the terminal location in a manner that avoids strain on the connecting lugs and maintain the required bending radius of conductors inside cabinets.

G. Follow the manufacturer's torque values to tighten lugs.

H. Before energizing the panel, the following steps shall be taken:

1. Retighten connections to the manufacturer's torque specifications. Verify that required connections have been furnished.

2. Remove shipping blocks from component devices and the panel interior.

3. Remove debris from panel interior.

I. Follow manufacturer's instructions for installation and for all low voltage wiring.

J. This contractor shall tag the cable at either end at the connection point. Label with the lighting control panel designation and room number designation. Labeling shall be done with a BROTHER® Model No. PT-1400 (P-touch) professional label maker, or approved equal, using a laminated type extra strength adhesive tape, Letters/numerals shall be black with a white background.

III. SERVICE, SUPPORT AND COMMISSONING

A. Start Up: This Contractor shall contact the system manufacturer at least 7 days before activation of the system. This Contractor shall connect the Link-2- Ethernet (for one BUS systems) or MetaServer (for multiple BUS systems) to the school's Intranet network switch. This Contractor shall contact PGCPS IT 14 days prior to startup for a dedicated IP address that will be assigned to the Link-2- Ethernet or MetaServer. Dedicated IP address shall be provided to factory technician, by this Contractor, upon request.

B. Ethernet factory support shall be available at no additional cost to the Contractor or Owner both during and after the warranty period. Factory to pre-program the lighting control system per plans and approved submittal, to the extent data is available. Text deleted. Upon request, manufacturer to provide remote Ethernet software at no added

cost to the system owner. No exceptions.

C. Upon completion of the installation of the entire lighting control system, and prior to the substantial completion of the project, this contractor shall have the system commissioned by an authorized system manufacturer's representative. This contractor shall be responsible for participation and coordination within the Commissioning process including but not limited to:

1. Verify proper installation and performance of the lighting control system.

2. Provide a factory trained lighting control system technician/programmer for use during system verification and functional performance testing.

3. Manipulate the lighting control systems to facilitate verification and performance testing.

4. Perform and clearly document all completed startup and system operational checkout procedures, providing a copy to the Owner.

5. Address current A/E punchlist items before functional testing.

6. Correct deficiencies (differences between specified and observed performance) as interpreted by the CA, Owner and A/E and retest the equipment.

7. On multi-phased projects, each phase shall have a separate startup by a factory trained lighting control system technician. Contractor to contact factory a minimum of 7 business days prior to technician being required to be onsite.

IV. CLEANING

A. Remove debris from the Lighting Control Panels, wipe dust and dirt from all components, and repaint marred surfaces with touch-up paint to match the original finish.

B. Clean photocell lens as recommended by manufacturer.

C. Clean all switch faceplates.

V. ON-SITE AS-BUILT DRAWINGS

A. The Contractor shall provide one (1) set of the as-built lighting floor plans (including site lighting plans associated with this lighting control system) and one (1) set of the lighting control system supplier's point-to-point as-built wiring diagrams and supporting drawings as hereinbefore described for permanent use on-site. The Contractor shall: laminate each page of these drawings; provide a rigid means for mounting such as 1/4-inch-thick x two (2) inch wide x width of the drawings through-bolted wood along the left edge of the drawings; furnish and install hanging hooks on the back of the Main Electric Room door; and hang the bound set of drawings. An additional PDF copy shall be furnished to PGCPS Master Electrician.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include furnishing and installing a complete operational occupancy sensor based lighting control system as shown on the Drawings, detailed in the manufacturer's submittal and as herein specified.

B. Work described in this section shall be coordinated with all applicable plans and specifications, including by not limited to interfacing with microprocessor based Lighting Control Systems, wiring, raceways, boxes and fittings, luminaires, and HAVC systems.

III. QUALITY ASSURANCE

A. Occupancy sensors shall conform to the requirements of the National Electrical Code (NEC), state and local codes, and these Specifications.

B. All components shall be listed by Underwriter's Laboratories, Inc. (UL) for their intended use and shall bear the UL label.

C. Products supplied shall be from a single manufacturer that has been continuously involved in manufacturing of occupancy sensors for a minimum of five (5) years. Mixing of manufacturers shall not be allowed.

D. Products shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rating of less than 1/3 of 1%.

E. Wall switch products must be capable of withstanding the effects of inrush current. Submittals shall clearly indicate the method used.

IV. COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

V. SUBMITTALS

A. Submittals are required in accordance with SECTION 260500 of these specifications. Submittals shall include, but not be limited to the following for review. Submittals not containing all of the information listed below will be rejected.

1. Manufacturers shall substantiate conformance to this specification by providing the necessary documents, performance data and wiring diagrams. Any deviations to the specifications must be clearly stated by letter and submitted.

2. Submit a scaled building lighting plan (minimum size of 1/16" = 1'-0") clearly marked by the manufacturer showing proper product, location and orientation of each sensor and power pack (switch pack). Plans shall show detection coverage patterns. If necessary for clarity, provide a 1/8" = 1'-0" scaled plan or one plan with coverage areas shown and another plan with the other information shown. Illegible drawings will be rejected.

3. Submit interconnections diagrams per major subsystem and interfacing with Lighting Control Panels (LCP) (Refer to SECTION 16505), showing proper wiring.

4. Submit standard catalog literature which includes performance specifications indicating compliance to the specification.

5. Catalog sheets must clearly state any load restrictions when used with electronic ballasts.

6. Field quality-control test reports.

7. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

VI. SYSTEM DESCRIPTION

A. The objective of this specification section is to ensure the proper installation of the occupancy sensor based lighting control system so that lighting is turned off automatically after reasonable time delay when a room or area is vacated by the last person to occupy said room or area.

B. The occupancy sensor based lighting control shall accommodate all conditions of space utilization and irregular work hours and habits.

VII. SYSTEM TEST AND ACCEPTANCE

A. Prior to the Architect/Engineer's final site visitation, and acceptance of each construction phase, this Contractor shall conduct a complete operation test of each system including each device. The systems shall test free from grounds, shorts, and other faults. All connections shall be thoroughly checked for mechanical and electrical connection. All equipment shall be demonstrated to operate in accordance with the requirements set forth in these Specifications and as shown on the Drawings.

B. This Contractor shall perform all tests in the presence of PGCPS Master Electrician. This Contractor shall furnish all personnel for use in the tests.

C. When the work on the system has been completed and is ready for final review, a visit shall be made by PGCPS Master Electrician at which time the Contractor shall demonstrate that the requirements of the Contract as it applies to this system have been carried out and that the system has been adjusted and operated in accordance herewith.

VIII. Training

A. Upon completion of the project, the Contractor and manufacturer's factory authorized representative shall provide a minimum of four (4) hours of training to familiarize the Owner with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems.

IX. WARRANTY

A. This[1] Contractor shall warrant all equipment furnished in accordance with this specification to be undamaged, free of defects in materials and workmanship, and in conformance with these specifications. The warranty shall include repair or replacement, and testing without charge to the Owner on all or any parts of equipment which are found to be damaged, defective or non-conforming. There shall be no deductibles applied to such warranty. Satisfactory warranty documents shall be furnished. Refer to SECTION 01740 WARRANTIES AND BONDS.

Part 2 - Products

I. MANUFACTURERS

A. The lighting occupancy sensors shall be manufactured by SENSORSWITCH, as listed or equal by GREENGATE (COOPER CONTROLS), HUBBELL, or WATTSTOPPER.

B. The listing of any manufacturer as "equal" does not imply automatic approval. This Contractor shall ensure submittals made are for sensors and associated equipment which meets or exceeds the specifications included herein.

II. LIGHTING OCCUPANCY SENSORS

A. Occupancy sensors shall consist of, but not be limited to the following:

1. Sensing technology shall be passive infrared (PIR), MicroPhonics (or ultrasonic), dual technology having both PIR and MicroPhonics (or ultrasonic).

2. Passive infrared sensors shall provide high immunity to false triggering from RFI (hand-held radios) and EMI (electrical noise in the line). The PIR sensors shall have a multiple segmented Fresnel lens, in multi-tier configuration, with grooves-in to eliminate dust and residue build-up.

3. MicroPhonics shall be used in conjunction with PIR (passive infrared) sensing technology to enable a sensor to provide dual-technology sensing that is

completely passive. MicroPhonics shall detect an occupant by detecting leading edge noises typical of human activity while filtering out building noises. The MicroPhonic sensing circuitry shall have automatic gain control to dynamically adapt to the sensor to its environment allowing it to filter out background noise.

4. Ultrasonic sensors shall be able to adjust the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled spaces. Ultrasonic operating frequency shall be crystal controlled at 32 kHz within ± 0.002% tolerance, or 40 kHz within ± 0.002% tolerance to assure reliable performance and eliminate sensor cross-talk. Sensors using multiple frequencies are not acceptable.

5. Dual technology sensors shall consist of PIR and MicroPhonics (or ultrasonic) technologies for occupancy detection.

6. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems and rated motor loads.

7. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.

8. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity for turning lights off, adjustable over a minimum range of 1 to 30 minutes. Settings shall be located on the sensor (not the control unit) and shall be recessed and concealed behind hinged door.to limit tampering.

9. In the event of failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall switch or lighting control panel until the sensor is replaced. This control shall be recessed to prevent tampering.

10. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.

B. Ceiling mounted room occupancy sensors shall be low voltage dual technology type consisting of passive infrared (PIR) and MicroPhonic (or ultrasonic) technologies with 360° coverage for large classrooms, open office spaces or areas up to 1600 square feet; SENSORSWITCH Model CM PDT 10. Sensors shall operate on 12 to 24 VAC or VDC and NEC Class 2 wiring. Each sensor shall be complete with one (1) power pack or two (2) power packs for rooms requiring two (2) lighting branch circuits. Rooms requiring multiple sensors may only require one (1) power pack for multiple sensors, where shown on the Drawings. Sensors shall also be equipped with an additional isolated relay.

1. Occupancy sensors shown on the Drawings to be powered from a Lighting Control Panel generally will not require a power pack.

C. Ceiling mounted (or wall mounted where shown on the Drawings) room occupancy sensors shall be low voltage dual technology type consisting of passive infrared (PIR) and MicroPhonics (or ultrasonic) technologies for directional one-way coverage for classrooms, offices or areas up to 1000 square feet when mounted on a 96-inch- high ceiling; SENSORSWITCH Model WV PDT 16. Sensors shall operate on 12 to 24 VAC or VDC and NEC Class 2 wiring. Each sensor shall be complete with one (1) power pack or two (2) power packs for rooms requiring two (2) lighting branch circuits. Rooms requiring multiple sensors may only require one (1) power pack for multiple sensors, where shown on the Drawings. Sensors shall also be equipped with an additional isolated relay for HVAC control.

1. Occupancy sensors shown on the Drawings to be powered from a Lighting Control Panel generally will not require a power pack.

2. Sensitivity Adjustment: Separate for each sensing technology.

3. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.

4. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.

5. Extra contact for HVAC control.

D. Corridor and corridor lobby ceiling mounted occupancy sensors shall be low voltage dual-technology passive infrared (PIR) and MicroPhonics (or ultrasonic) technology type with coverage of approximately 50 linear feet; SENSORSWITCH Model CM PDT 10. Sensors shall operate on 12 to 24 VAC or VDC and NEC Class 2 wiring. Sensors shall be powered from a lighting control panel or power pack and/or as shown on the Drawings. Sensors shall also be equipped with an additional isolated relay.

1. Detection Coverage (Corridors): Detect occupancy anywhere shown on the drawings with 90 linear feet coverage, 45 feet at each side

E. Wall switch occupancy sensors shall be line voltage dual-technology passive infrared (PIR) and MicroPhonic (or ultrasonic) technology type with coverage of approximately 30 to 40 square feet for use in small utility/storage rooms, small toilet rooms, etc. as shown on the Drawings; SENSORSWITCH Model WSX PDT-IV. Sensors shall operate on 120 or 277 volts. Load rating shall be 0 to 800 watts ballast or tungsten at 120 volts and 0 to 1200 watts ballast at 277 volts. Sensor shall use zero-cross circuitry to detect when the sine wave crosses at the “zero-point” so as to minimize wear on the switching contact.

1. Sensitivity Adjustment: Separate for each sensing technology.

2. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any

portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.

3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 400 sq. ft. when mounted on a 48-inch on the wall.

4. Provide single or double buttons as shown on the drawings.

5. Contractor shall supply stainless steel cover plates, not the plastic cover plates that may be included in the switch packaging. See Specification Section 16130 for type.

F. Wall switch occupancy sensors, with dual ON/OFF button switches and dual relays for controlling two lighting loads or circuits, shall be line voltage dual-technology passive infrared (PIR) and MicroPhonic (or ultrasonic) technology type with coverage of approximately 30 to 40 square feet for use in small utility/storage rooms, small toilet rooms, etc. as shown on the Drawings; SENSORSWITCH Model WSX PDT 2P-IV. Sensors shall operate on 120 or 277 volts. Load rating shall be 0 to 800 watts ballast or tungsten at 120 volts and 0 to 1200 watts ballast at 277 volts.

1. Contractor shall supply stainless steel cover plates, not the plastic cover plates that may be included in the switch packaging. See Specification Section 16130 for type.

III. POWER PACKS AND AUXILIARY RELAY PACKS CONTROL UNITS

A. Power packs shall accept 120 or 277 volts, be plenum rated, and provide Class 2 power to a minimum of two (2) occupancy sensors. Power packs shall be able to externally mount through a 1/2” knock-out on a standard electrical enclosure (junction box) and be an integrated, self-contained unit consisting internally of an isolated load switching control relay (load rated 20 amperes at 120 or 277 volts) and a transformer to provide low voltage power; SENSORSWITCH Model PP 20 Power pack shall provide a minimum of 150mA at 15 VDC to drive occupancy sensors and auxiliary relay packs.

B. Power packs shall use zero-cross circuitry to detect when the sine wave crosses at the “zero-point” so as to minimize wear on the switching contact.

C. Auxiliary relay packs shall be the same self-contained type unit as the power pack hereinbefore described, except shall not include a transformer; SENSORSWITCH Model SP 20. The auxiliary relay pack shall be used to control another lighting load with a different line voltage than the power pack. Auxiliary relay packs shall be powered from a power pack with 15 VDC.

IV. ISOLATED RELAY

A. Sensors hereinbefore described to include an isolated relay shall have the relay be internal with Normally Open, Normally Closed and Common outputs for use with

Lighting Control Panels (LCP), HVAC control, and other control options as shown on the Drawings. Sensors utilizing separate components or specially modified units to achieve this function shall not be acceptable.

B. Corridor and other location occupancy sensors indicated on the Drawings to interface with a Lighting Control Panel (LCP) shall have the isolated relay send a contact closure signal to the Lighting Control System. These sensors shall be powered from the LCP and not by a power pack. Operation of sensors in corridors and other areas where sensors are interfaced with the lighting control system shall operate in a manner such the lighting in the controlled areas is “held-on” during normal school operating hours. After normal school hours, these controlled areas shall respond to the occupancy sensors for lighting control. See the Drawings and details for the sequence of operations via the LCP.

V. WIRING

A. Low voltage wiring between occupancy sensors and power packs shall be three (3) conductor, No. 18 AWG, unshielded, plenum rated with a temperature range for dry locations of minus ten (10) degrees C to sixty (60) degrees C. A cable that will meet this specification is WEST PENN Cat. No. 25234B.

B. Low voltage wiring between occupancy sensors and Lighting Control Panels (LCP) shall be three (3) conductor, No. 18 AWG, unshielded, plenum rated with a temperature range for dry locations of minus ten (10) degrees C to sixty (60) degrees C. A cable that will meet this specification is WEST PENN Cat. No. 25234B.

Part 3 - Execution

I. INSTALLATION

A. It shall be the Contractor’s responsibility to provide the quantity of occupancy sensors required for complete and proper volumetric coverage to completely cover the controlled areas. Rooms shall have ninety (90) to one hundred (100) percent volumetric coverage to completely cover the controlled areas to accommodate all occupancy habits of single or multiple occupants at any location within the rooms. Proper judgment must be exercised in executing the work so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations, interference of structural components, or furnishings in the rooms or spaces. The locations and quantities of sensors shown on the Drawings are based on coverage patterns of SENSORSWITCH sensors. Sensors of other approved manufacturers may require different quantities of sensors for full coverage of spaces being controlled. The sensors shown on the drawings are diagrammatic and do not necessarily show the exact locations of the sensors. This contractor shall confirm with the occupancy sensors manufacturer the exact quantities of sensors and power packs at time of bid. This Contractor shall provide additional sensors if required to properly and completely cover the respective rooms at no additional cost to the Owner.

B. Line voltage wall switch type occupancy sensors shall be installed in a suitable wall outlet box in a method recommended by the equipment manufacturer similar to a standard line voltage light switch.

C. Low voltage occupancy sensors shall be securely mounted to a ceiling or wall mounted junction box in a method recommended by the sensor manufacturer. Ceiling mounted junction boxes shall be supported from the building structure with no less than one (1) ¼" threaded rod. Sensors shall be wired as detailed on the Drawings and as recommended by the equipment manufacturer.

D. Power packs shall be located in accessible ceiling spaces and securely mounted to a standard electrical enclosure (junction box) through a standard 1/2" chase nipple. Plastic clips into the junction box shall not be acceptable. Junction box shall be supported from the building structure with no less than one (1) ¼" threaded rod. All Class 1 wiring shall pass through the chase nipple into the junction box without any exposure of wire leads. Low voltage Class 2 wiring to the sensors shall not be exposed in finished spaces. Power packs shall be wired as detailed on the Drawings and as recommended by the equipment manufacturer.

E. Supports shall not terminate or be fastened directly to the roof decking except where specifically approved by the Owner.

F. Wiring:

1. Wiring Method: Comply with Division 16 Section "Conductors and Cables." All low voltage field wiring in finished and unfinished spaces shall be installed by this Contractor in 1/2-inch conduit and/or surface metal raceway as shown on the Drawings or hereinbefore specified elsewhere. Conduit fill shall not exceed the conduit space capacity.

2. All low voltage field wiring to be installed in areas without a ceiling or in areas without an accessible ceiling shall be installed by this Contractor in 1/2-inch conduit.

3. All low voltage field wiring to be installed in areas with accessible ceilings shall be installed by this Contractor bundled together and run exposed above the ceilings. Bundles shall be supported by "J" hooks mounted not more than four (4) feet on center. "J" hooks shall be dedicated to the wiring specified in this specification section.

4. All low voltage field wiring shall be run at right angles to the building structure.

5. All low voltage field wiring shall be installed below the roof/floor structural supports (joists, beams, girders, etc.). Wiring installed between the structural supports mentioned above and the roof or floor deck will not be acceptable.

6. All low voltage field wiring penetrations through new and/or existing walls shall

be sleeved. Minimum sleeve size shall be one (1) inch. All sleeves shall be bushed both sides.

7. All low voltage field wiring for the occupancy sensor systems shall be furnished and installed by this Contractor. All junction box covers shall be stenciled for distinct identification.

8. All wiring connections shall be made by this Contractor as shown on the Drawings and as recommended by the equipment manufacturer. Splices shall be made only in junction boxes.

9. All occupancy sensor system wiring shall be checked and tested by this Contractor to insure the system is free from grounds, opens, and shorts.

10. Contractor shall test all low voltage cable for integrity and proper operation of the system.

G. The Contractor shall arrange a pre-installation meeting with the occupancy sensors manufacturer's factory authorized representative, at the project facility to verify proper placement of sensors and installation criteria.

II. TESTING

A. Sensor Testing and Adjustment:

1. At the time of installation, the Contractor shall be responsible for testing and adjusting each sensor for proper detection of motion appropriate to room usage. The Contractor shall follow the testing and adjustment procedures as written in the installation instructions for each sensor model. Note: Due to room conditions, it may be necessary for the Contractor to make adjustments, change the location or type of sensor to obtain proper operation and coverage of the system in each room and should therefore make labor and material allowances for such changes and adjustments.

III. DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work under this Section shall include furnishing and installing TP-1 dry-type energy efficient transformers complete as shown on the Drawings and herein specified. Provide all lugs, accessories and mounting hardware necessary for proper installation and operation.

III. SUBMITTALS

A. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.

IV.

A. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.

2. Source quality-control test reports.

3. Field quality-control test reports.

4. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

V. QUALITY ASSURANCE

A. Source Limitations: Obtain each transformer type through one source from a single manufacturer.

B. All equipment, materials and their installation shall conform to the requirements of the National Electrical Code (NEC), local code requirements, and these Specifications.

C. Transformers shall meet the requirements of Federal Law 10 CFR Part 431 “Energy Efficiency Program for Certain Commercial and Industrial Equipment” and bear the Energy Star® label.

D. The transformer manufacturer shall be ISO 9001 or 9002 certified.

E. All equipment and material shall be listed by Underwriter's Laboratories, Inc. (UL) for their intended use and shall bear the UL label.

F. Equipment shall be constructed and tested in accordance with National Electrical Manufacturer's Association (NEMA) standards including TP-1, TP-2 and TP-3.

G. Submittals are required in accordance with SECTION 16010 of these Specifications. The following minimum information shall be submitted:

1. Outline dimensions and weights.

2. Technical certification sheet.

3. Transformer ratings including:

a) kVA

b) Primary and secondary voltage.

c) Taps.

d) Design impedance.

e) Insulation class and temperature rise.

f) Sound level.

4. Product data sheets.

VI. DELIVERY, STORAGE AND HANDLING

A. Handle transformers in accordance with manufacturer’s recommendations. Utilize factory provisions for all lifting, rigging, or hoisting.

B. Store transformers prior to installation in a temperature and humidity controlled space. If such a space is not available, apply temporary heat in accordance with the manufacturer’s instructions within each ventilated type transformer case to exclude moisture and condensation.

VII. COORDINATION

A. Coordinate size and location of concrete bases with actual transformer provided. Cast anchorbolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 033000.

B. Coordinate installation of wall-mounting and structure-hanging supports with actual transformer provided.

Part 2 - Products

I. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ACME Electric Corporation; Power Distribution Products Division.
2. Eaton Electrical Inc.; Cutler-Hammer Products.
3. Magnetek Power Electronics Group.
4. Schneider Electric; Square D
5. Siemens Energy & Automation, Inc.

II. MATERIALS AND COMPONENTS

A. Dry-type energy efficient transformers shall be indoor, dry, ventilated, quiet type and shall be constructed and tested in accordance with the latest applicable standards of ANSI, NEMA and UL.

B. Ratings:

1. KVA and voltage ratings shall be as shown on the drawings.
2. Transformers shall be designed for continuous operation at rated kVA, for 24 hours a day, 365 days a year operation, with normal life expectancy as defined in ANSI C57.96.
3. Transformer sound levels shall not exceed the following ANSI and NEMA levels for self-cooled ratings:

0	to	9 kVA	40 dB
10	to	50 kVA	45 dB
51	to	150 kVA	50 dB
151	to	300 kVA	55 dB
301	to	500 kVA	60 dB

4. Transformers shall be low loss type with minimum efficiencies as listed in NEMA TP-1 when operated at 35% of full load capacity. Efficiency shall be tested in accordance with NEMA TP-2.

C. Insulation Systems:

1. Transformer insulation system shall be 220 degrees C insulation system with 150-degree C rise, ventilated design.

2. Required performance shall be obtained without exceeding the above indicated temperature rise in a 40 degrees C maximum ambient, and a 24-hour average ambient of 30 degrees C.

3. All insulation materials shall be flame-retardant and shall not support combustion as defined in ASTM Standard Test Method D635.

D. Core and Coil Assemblies:

1. Transformer core shall be constructed with high-grade, nonaging, silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Maximum magnetic flux densities shall be substantially below the saturation point. The transformer core volume shall allow efficient transformer operation at 10% above the nominal tap voltage. The core laminations shall be tightly clamped and compressed. Coils shall be wound of high quality electrical grade aluminum with continuous wound construction.

2. On three-phase units rated 15 kVA and above the core and coil assembly shall be impregnated with non-hydroscopic, thermosetting varnish and cured to reduce hot spots and provide a flame retardant seal and seal out moisture. The assembly shall be installed on vibration-absorbing pads. There shall not be any metal-to-metal contact between the core and coil assembly and the enclosure except for a flexible safety ground strap.

E. Three-phase transformers rated 15 through 500 kVA shall be provided with six 2- 1/2% taps, two above and four below rated primary voltage.

F. Enclosure:

1. The enclosure shall be made of heavy-gauge steel. All transformers shall be equipped with a wiring compartment suitable for conduit entry and large enough to allow convenient wiring. The maximum temperature of the enclosure shall not exceed 90 degrees C. The core of the transformer shall be visibly grounded to the enclosure by means of a flexible grounding conductor sized in accordance with applicable UL and NEC standards.

2. On three-phase transformers rated 15 kVA and above the enclosure construction shall be ventilated, NEMA 2, drip-proof, with lifting holes. All ventilation openings shall be protected against falling dirt. Enclosures shall be finished with ANSI gray color, weather-resistant enamel.

3. On ventilated outdoor units provide suitable weathershields over ventilation opening, conforming to the requirements of NEMA 250, Type 3R. Suitable screens shall be provided to prevent insertion of foreign debris and animals in the ventilation openings.

G. Dry-type transformers shall be as manufactured by EATON/CUTLER-HAMMER, GENERAL ELECTRIC, SIEMENS, or SORGEL (SQUARE D).

III. NAMEPLATE

A. Transformers shall have nameplates of 1/16-inch-thick laminated plastic with 3/16-inch-high white letters on a black background. Nameplates shall identify the transformer and shall be mounted on the top front edge of the enclosure. Nameplates shall be screw fastened using stainless steel corrosion resistant screws. Nameplates for transformers on emergency power shall have a red background.

Part 3 - Execution

I. FACTORY TESTING

A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with latest version of ANSI and NEMA standards.

1. Ratio tests at the rated voltage connection and at all tap connections.

2. Polarity and phase relation tests on the rated voltage connection.

3. Applied voltage tests.

4. Induced potential test.

5. No-load and excitation current at rated voltage on the rated voltage connection.

II. EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

III. INSTALLATION

A. Transformers, shown on the Drawings to be floor mounted shall have a four (4) inch high by four (4) inch greater all sides concrete base. Connections shall be made with flexible metal conduit.

B. Transformer manufacturer's nameplates, marked in accordance with NEMA Specifications, shall be permanently attached to the transformer in a readily accessible position.

C. Transformer secondary neutral shall be grounded as per NEC requirements, and/or hereinafter specified.

D. This Contractor shall install the transformer to ensure that the minimum clearances required by the transformer manufacturer are provided. These clearances shall be clearly labeled on the transformer by the manufacturer.

E. Install units plumb, level and rigid without distortion.

IV. ADJUSTMENTS AND CLEANING

A. On completion of installation, inspect components. Remove paint splatters and other spots, dirt and debris. Repair scratches and mars on finish to match original finish. Clean components internally using methods and materials recommended by the manufacturer.

B. Adjust transformer taps to provide optimum voltage conditions at utilization equipment throughout normal operating cycle of the facility. Measure and record primary and secondary voltages and tap settings and submit with test results. Test results shall be displayed on site adjacent to transformer.

V. FIELD TESTING

A. Include the following minimum inspections and tests according to manufacturer’s written instructions. Comply with IEEE C57.12.91 for test methods and data correction factors.

B. Inspect accessible components for cleanliness, mechanical and electrical integrity and damage or deterioration. Verify that temporary shipping bracing has been removed. Include internal inspection through access panels and covers.

C. Inspect bolted electrical connections for tightness according to manufacturer’s published torque values or, if not available, those specified in UL 486A and UL 468B.

D. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

E. Remove and replace units that do not pass tests or inspections and retest as specified

above.

F. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of transformer connections.

1. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.

2. Perform one follow-up infrared scans of transformers at 11 months after Substantial Completion.

3. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.

G. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

END OF SECTION

Fuses Section 262413

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work under this Section shall include furnishing and installing a complete distribution switchboard(s) as shown on the Drawings and herein specified.

A. Section Includes:

1. Service and distribution switchboards rated 600 V and less.

III. QUALITY ASSURANCE

A. All equipment, materials, and their installation shall conform to the requirements of the National Electrical Code (NEC), local code requirements, and these Specifications.

B. All equipment and material shall be listed by Underwriter's Laboratories, Inc. (UL) for their intended use and shall bear the UL label. Comply with UL 891.

C. Equipment shall be constructed in accordance with National Electrical Manufacturer's Association (NEMA) standards.

D. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.

E. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

F. Submittals are required in accordance with SECTION 16010 of these Specifications. The manufacturer shall furnish printed product data and also provide drawings to include components, materials, finishes, detailed plan and elevation views, required conduit rough-in openings, anchors, accessories, and wiring diagrams. Submittals shall also include, but not be limited to the following:

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.

2. Detail enclosure types for types other than NEMA 250, Type 1.

3. Detail bus configuration, current, and voltage ratings

1. Lug sizes.

2. Bus arrangements with all ampere ratings noted.

3. Type and spacing of bus supports.

4. Maximum short-circuit bracing.

5. Fusible switch units size, interrupting rating, and fuse rating.

6. Circuit breaker trip ratings and frame sizes.

7. Circuit breaker and fusible switch units arrangements.

8. Detail utility company's metering provisions with indication of approval by utility company.

9. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

10. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards.

11. Include schematic and wiring diagrams for power, signal, and control wiring.

12. The results of coordination and short circuit study shall apply for all switchboards prior to submission.

13. Overall dimensions.

14. Provisions for future.

15. Metering.

16. Wiring diagrams for the single-phase protection, blown fuse protection, and ground fault protection systems.

17. Surge protective devices when SPDs are integral with the switchboard. Provide submittals as described in Section 16418.

B. The distribution switchboard's utility metering provisions shall be constructed to comply with all of the electric utility company's requirements.

C. The distribution switchboard(s) shall be factory engineered and shall be a completely assembled unit, complete as shown on the Drawings and/or herein specified with provisions for electric utility company's metering equipment where required.

1.2 DELIVERY, STORAGE AND HANDLING

A. Deliver material and products in factory labeled packages. Store and handle in strict compliance with manufacturer’s instructions and recommendations.

B. Each switchboard section shall be delivered in individual shipping splits and

individually wrapped for protection and mounted on shipping skids.

C. Store in a clean, dry space. Maintain factory protection and /or provide an additional heavy canvas or heavy plastic cover to protect structure from dirt, water, construction debris, and traffic. Where applicable, provide adequate heating within enclosures to prevent condensation.

D. Handle in accordance with NEMA PB2.1 and manufacturer’s written instructions. Lift only by lifting means provided for this express purpose. Handle carefully to avoid damage to switchboard internal components, enclosure and finish.

1.3 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above switchboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not exceeding 104 deg F b.
Altitude: Not exceeding 6600 feet

B. Service Conditions: NEMA PB 2, usual service conditions, as follows:

1. Ambient temperatures within limits specified. 2. Altitude
not exceeding 6600 feet

Part 2 - Products

I. MANUFACTURERS

A. The distribution switchboard(s) shall be as manufactured by CUTLER-HAMMER, GENERAL ELECTRIC, SIEMENS, or SQUARE D.

B. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum of ten (10) years.

II. MATERIALS AND COMPONENTS

A. Enclosure Construction:

1. The switchboard shall be of the modular type construction, constructed in accordance with the latest NEMA PB-2 and UL 891 standards with the required number of vertical sections bolted together to form one metal enclosed rigid switchboard. Enclosure construction shall be NEMA 1 indoor. Service entrance switchboards shall be suitable for use as service equipment and be labeled in accordance with UL requirements.

2. The switchboard framework shall be fabricated on a dieformed steel base or base assembly consisting of formed steel channel welded or bolted together to rigidly support the entire shipping unit for moving on rollers and floor mounting. The framework shall be formed code gauge steel, rigidly welded and bolted together to support all cover plates, bussing, and component devices during shipment and installations.

3. Each switchboard section shall have an open bottom and individual removable top plate for installation and termination of conduits. The sides, top and rear shall be covered with removable screw-on code gauge steel plates. All edges of front covers or hinged front panels shall be formed. Provide adequate ventilation within the enclosure.

4. The switchboard shall include all protective devices, provision only spaces for future protective devices, and equipment as listed on the Drawings and specified herein with necessary interconnections, instrumentation and control wiring.

5. Top and bottom conduit area(s) shall be clearly shown and dimensioned on

the shop drawings. The wireway front covers shall be hinged to permit access to the branch overcurrent protective device load side terminals without removing the covers.

6. All sections of the switchboard shall be rear aligned as shown on the Drawings. All protective devices shall be group mounted. Protective devices shall be front removable and load connections front accessible enabling the switchboard to be mounted against a wall. All sections of the switchboard shall also be front aligned unless specifically shown otherwise on the drawings.

7. The switchboard shall have fully equipped provision spaces for future protective devices as shown on the Drawing. Remaining space not identified on the Drawings shall be fully bussed and pre-drilled for future protective devices that do not have established frame sizes. This is in addition to the scheduled space or spare branches specified or shown on the Drawings.

B. Bus Requirements:

1. Switchboard bussing shall be rigid bus bars of silver-plated copper having ninety-eight (98) percent conductivity and shall be rated for a minimum of one

(1) square inch per one thousand (1,000) ampere capacity with a maximum average temperature rise sized for UL at sixty-five (65) degrees C.

2. The bus bars shall be rigidly braced to comply with the integrated equipment rating of the switchboard. The neutral bus shall be full capacity and sized as shown on the Drawings. The main horizontal bus bars between sections shall be full size, non-tapered for the complete length of the switchboard and located to permit a maximum of available conduit area. The through bus on the end section shall be extended and pre- drilled to allow the addition of future sections. The bus bar supports, connections, and joints are to be bolted with Grade five (5) carriage bolts and conical spring-type (Belleville) washers. All hardware used on conductors shall be high-tensile strength and zinc-plated.

3. A ground bus and lug shall be furnished firmly secured to each vertical section structure and shall extend the entire length of the switchboard. Provisions for the addition of future switchboard sections shall be provided. The manufacturer shall furnish a bus bond between the neutral and ground bus bars.

4. Ground Bus: 1/4-by-2-inch-hard-drawn copper of 98 percent conductivity, equipped with compression connectors for feeder and branch-circuit ground conductors.

5. The manufacturer shall furnish a 1/16-inch-thick plastic mimic bus of a contrasting color. Tape will not be acceptable.

6. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with compression connectors for outgoing circuit neutral cables.

C. Wiring/Terminations:

1. Small wiring, necessary fuse blocks and terminal blocks within the switchboard shall be furnished as required. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams.

2. Mechanical-type terminals shall be provided for all line and load terminations suitable for copper or aluminum cable rated for 75 degrees C of the size as indicated on the Drawings.

3. Lugs shall be provided in the incoming line section for connections of the main grounding conductor. Additional lugs for connection of other grounding conductors shall be provided as indicated on the Drawings.

4. All control wiring shall be type SIS, bundled and secured with nylon ties. Insulated locking spade terminals shall be provided for all control connections, except where saddle type terminals are provided integral to a device. All current transformer secondary leads shall first be connected to conveniently

accessible short-circuit terminal blocks before connecting to any other device. All groups of control wires leaving the switchboard shall be provided with terminal blocks with suitable numbering strips. Provide wire markers at each end of all control wiring.

D. Ratings: The switchboard's system voltage and amperage shall be as indicated on the Drawings. The switchboard, as a complete unit, shall be given a single integrated equipment rating by the manufacturer of 65,000 amperes minimum or as determined by the Short-Circuit Coordination Study whichever is higher and shall be so labeled. Such rating shall be established by actual tests by the manufacturer on similar equipment available and shall be furnished with the submittal.

E. Incoming Service:

1. The utility metering compartment (C/T cabinet) shall also serve as the incoming service entrance compartment. Suitable compression lugs in the quantity and size required to terminate incoming utility service entrance cables shall be provided in accordance with the Contract Drawings and the requirements of the local electric utility company. Bus work shall include provisions for mounting utility company current transformers and potential transformers or potential taps as required by the utility company. Provide service entrance label and provide necessary applicable service entrance features per NEC and local code

requirements.

2. The C/T cabinet shall be an integral part of the switchboard, complete with a barrier to separate the utility metering compartment from the rest of the switchboard. It shall be of the height necessary, and meet all other requirements of the electric utility company. The entire cabinet shall have a double hinged door with sealable hasp and knurled captive screws.

3. A separate incoming cable pull section shall not be required.

F. Fire Pump Tap: A fire pump tap section shall be provided as integral part of the switchboard. It shall be on the line side of the main disconnecting devices of the switchboard and contain only through bus and tap lugs to feed the fire pump.

G. Bolted Pressure Switches:

1. All main switches indicated on the Drawings 800 amperes and larger shall be true bolted contact load-break type with provisions for NEMA Class L fuses (fuses shall be furnished and installed by this Contractor). The stored energy deadfront operating mechanism shall include disk springs, compressed and released by the operating handle, to provide quick-positive switching action independent of the speed with which it is operated. The mechanism shall be designed so that the switch can be closed only after the opening spring has been charged, ready for electrical opening by solenoid or manual opening by mechanical pushbutton.

2. The operating handle shall be mechanically interlocked with the fuse access door and have provisions for padlocking in the OPEN position. An external mechanical flag shall be provided to identify whether the switch is either open

or closed.

3. Switches, with Class L fuses installed, shall be rated for use on systems capable of withstanding and closing into circuits having available fault currents of 200,000 RMS symmetrical amperes at 600 VAC maximum. Switches shall have an interrupting rating of twelve (12) times the continuous rating at 240, 480, and 600 VAC and capable of carrying 100% of rated current and shall have been tested in accordance with UL Subject 977. Switches shall have power terminals to accommodate either cable or bolted bus connections. Cable lugs, when used, shall be rated for use with 90 degrees C wire insulation (sized according to the 75-degree C temperature rating in the NEC). High-pressure contact switches do not meet the intent of these specifications.

4. The switch shall be complete with single phase protection to open the main device upon loss of any single phase but not upon simultaneous loss of all three (3) phases.

5. The switch shall be complete with separate blown fuse protection to open the main bolted pressure switch if one (1) or more of the Class L fuses operate.

6. The switch shall have two (2) sets of auxiliary contacts (2 normally open and 2 normally closed) for switch position monitoring.

7. Switch(es) shall be PRINGLE type CBC or approved equal.

H. Ground Fault Protection:

1. A zero-sequence type ground fault protection system shall be included for each main bolted pressure service switch as shown on the Drawings or as required by NEC. It shall consist of a current sensor enclosing all phase and neutral conductors of the circuit to be monitored, and appropriate relaying equipment to provide the desired ground fault current sensitivity and time-current response characteristics. The main switch shall be equipped to function in conjunction with the other elements of the ground fault protection system. Installation of the equipment shall be in all respects in accordance with the manufacturer's recommendations.

2. A current sensor shall be provided of the size necessary to encircle the phase conductors and the neutral conductor of the circuit to be monitored. Current sensor output shall be coordinated with the required input to the relay. A test winding shall be included to simulate the flow of ground fault current through the current sensor in order to test the operation of the ground fault protection system including sensor pick-up relay, and circuit protective device operation. The frame of the current sensor shall be so constructed that one leg can be opened to allow removal of installation around cable or bus without disturbing the cable or requiring drop-links in the bus.

3. The ground fault relay shall be of solid state construction, except that a coil operated output relay shall be provided to control 120-volt power to operate the associated fusible bolted pressure switch ground fault trip mechanism. The relay shall require 120-volt power to operate the associated main device.

Adjustable pickup current sensitivity for ground currents from 200 amperes to 1200 amperes shall be provided. A calibrated dial shall be provided for setting the current pickup point in the field. Settings for individual relays shall be 1200 amperes or as determined by the Short-Circuit Coordination Study whichever is lower. Time delay provided by the relay circuitry shall be nominally 0.2 seconds or as determined by the Short-Circuit Coordination Study and shall be permanently calibrated. A self-contained test circuit utilizing the test coil provided in the current sensor shall be incorporated in the system. The test circuit shall be part of the monitor panel that shall be mounted on the front cover of the switchboard.

I. Fusible Switches: Main switches 600 amperes and smaller and feeder protective devices shall consist of fusible switch units as indicated on the Drawings. The fusible switch units shall be quick-make, quick-break type. The units shall be listed by UL for service entrance use. The fusible switch units shall be group mounted in panel-type construction. Each unit shall be enclosed in a separate steel enclosure. The enclosure shall employ a hinged cover for access to the fuses which shall be interlocked with the operating handle to prevent opening the cover when the switch is in the ON position. This interlock shall be constructed so that it can be released with a standard electrician's tool for testing fuses without interrupting service. The units shall have padlocking provisions in the OFF position and the operating handle position shall give switch position indication, i.e., horizontal OFF, diagonal ON. This Contractor shall furnish and install BUSSMANN "LIMITRON", or approved equal, dual element fuses of the ratings noted on the Drawings.

J. Molded Case Circuit Breakers:

1. Feeder protective devices shall consist of molded case circuit breakers as indicated on the Drawings, equipped with individually insulated, braced, and protected connectors. The front faces of all circuit breakers shall be flush with each other.

2. The circuit breakers shall be operated by a toggle type handle and shall have a quick-make, quick-break over-center switching mechanism that shall be mechanically trip free from the handle so that the contacts cannot be held closed against short circuits and abnormal currents. Tripping due to overload or short circuit shall be clearly indicated by the handle automatically assuming a position midway between the manual "ON" and "OFF" positions. All latch surfaces shall be ground and polished. All poles of a multi-pole breaker shall be so constructed that they open, close, and trip simultaneously.

3. The circuit breakers shall be completely enclosed in a molded case. Non-interchangeable trip breakers shall have their covers sealed; interchangeable trip breakers shall have the trip unit sealed to prevent tampering. Ampere ratings shall be clearly visible. Contacts shall be non-welding silver alloy. Arc extinction shall be accomplished by means of arc chutes consisting of metal grids mounted in an insulating support. Breakers shall be of the bolt-on or I-Line type; plug-in, plug-on, and clamp-on circuit breakers shall not be acceptable.

4. Circuit breakers shall be 80% rated unless indicated on the Drawings to be 100% rated.

5. Circuit breakers shall have a minimum symmetrical interrupting capacity as indicated on the Drawings. The interrupting ratings of the circuit breakers shall be at least equal to, or greater than, the available short circuit at the line terminals and not less than those values shown on the Drawings and specified in this specification section or as determined by the Short-Circuit Coordination Study

whichever is higher.

6. Circuit breakers shall be listed with UL, conform to the applicable requirements of the latest issue of NEMA Standards Publication No. AB1.

7. Circuit breaker frames 250 ampere and below shall have thermal- magnetic trip units, with inverse time-current characteristics, unless otherwise indicated on the Drawings.

   a) Automatic operation of all circuit breakers shall be obtained by means of thermal-magnetic tripping devices located in each pole providing inverse time delay and instantaneous circuit protection.

   b) Circuit breaker frames shall be ambient compensating in that, as the ambient temperature increases over 40 C, the circuit breaker automatically derates itself to better protect its associated conductor.

   c) Thermal-magnetic circuit breakers 250A and above shall have thermal magnetic interchangeable trip units, unless otherwise indicated on the Drawings.

8. Circuit breaker frames 400 ampere and above shall have microprocessor-based RMS sensing trip units, unless otherwise indicated on the Drawings.

   a) Solid State sensing shall measure true RMS current with capability to measure through to the 21st harmonic. Automatic operation of all circuit breakers shall be obtained by means of solid state tripping elements providing inverse time delay and instantaneous and short-time circuit protection. Continuous current rating shall be adjustable from 20% to 100% of trip unit rating. Long-time delay and instantaneous trip ratings shall also be adjustable. The short time pick-up trip shall have adjustable pick-up settings at definite times and with I2t delay.

   b) Longtime current adjustment shall be possible without the need for a rating plug.

   c) Feeder circuit breakers shall be provided with integral ground fault protection. Ground fault pick-up shall be adjustable from 20% to 70% of the breakers maximum continuous current rating, but in no case, be greater than 1200A. Ground fault time delay shall be adjustable with three (3) I2t delay settings.

d) Solid State circuit breakers shall have built-in test ports for testing the long-time delay, instantaneous, and ground fault functions of the breaker by means of a test set.

e) Provide a test set capable of testing all circuit breakers with a built-in test port.

9. Circuit breaker accessories: Provide shunt trips, bell alarms and auxiliary switches, etc. as may be shown on the drawings. All accessories shall be UL Listed for field installation.

10. Circuit breakers shall be manufactured by the same manufacturer as the switchboard and factory installed.

11. Where indicated, circuit breakers shall be UL listed for series application.

12. Large permanent individual circuit numbers shall be affixed to each breaker in a uniform position.

K. Nameplates:

1. Each device installed in the switchboard (including the C/T cabinet) shall be identified with a suitable nameplate, engraved as indicated on the Drawings. Nameplates shall be white phenolic with engraved black letters not less than 3/8" block style. The emergency service nameplates shall be red with white letters. Nameplates shall be screw fastened.

2. Furnish master nameplate giving switchboard designation, voltage and ampere rating, short-circuit rating, manufacturer's name, general order number, and item number.

L. All exterior and interior steel surfaces of the switchboard shall be properly cleaned and provided with a rust-inhibiting phosphatized coating. Color and finish of the switchboard shall be ANSI 61 gray.

III. METERING

A. A separate digital meter shall be panel mounted in the front face of the switchboard. The information and capabilities provided by the meter shall include, but not be limited to the following:

1. Current (amperes) per phase.

2. Voltage, phase-to-phase and phase-neutral.

3. Real Power (kW), per phase and three phase total.

4. Reactive Power (kVAR), per phase and three phase total.

5. Apparent Power (kVA), per phase and three phase total.

6. Power Factor (true), per phase and three phase total.

7. Frequency readings.

8. Real Energy (kWh), three phase total.

9. Reactive Energy (kVARh), three phase total.

10. Apparent Energy (kVAh), three phase total.

11. Energy Accumulation modes, signed, absolute, energy in, energy out.

12. Neutral current measurements.

13. Demand Current, per phase and neutral, present and peak.

14. Real Power Demand (kWd) readings, three phase total, present and peak.

15. Reactive Power Demand (kVARd) readings, three phase total, present and peak.

16. Apparent Power Demand (kVAd) readings, three phase total, present and peak.

17. Total Harmonic Distortion (THD) readings, voltage and current, per phase, provided as individual harmonic magnitudes up to the 31st harmonic, and as total odd, total even and total overall harmonic distortion; all readings given as a percentage of fundamental.

18. Date and Time Stamping, peak demands, power up/restart and resets.

19. Onboard Alarms for over/under voltages (per phase L-L, L-N), and voltage unbalance.

20. Minimum and Maximum readings.

B. The meter shall be accurate to 0.25% of readings plus 0.05% of full scale for voltage and current sensing, and 0.5% of reading plus 0.05% of full scale for power and energy, accurate through the 31st harmonic.

1. These accuracies shall be maintained for both light and full loads.

2. No annual re-calibration by users shall be required to maintain these accuracies.

3. Voltage and current for all phases shall be sampled simultaneously to assure high accuracy.

C. The meter shall be provided with a Modbus RTU serial or Modbus-TCP Ethernet communications port for open protocol integration of the electrical data into the BAS.

The Meter manufacturer shall provide all register data and support to the BAS Integrator onsite to provide a seamless integration of the data into the BAS.

D. The meter data communications shall be optically isolated to provide reliable operation.

E. The meter shall be equipped with backlit, two-line or greater LCD display.

F. All meter setup information and reset commands shall be password protected.

G. The meter shall have a KYZ pulse initiator for communication of kWh, kVARh, or kVAh information to third party energy management systems shall be provided.

H. Metering transformers shall be provided to support the requirements of the meters specified herein, UL listed or recognized.

IV. SURGE PROTECTIVE DEVICE (SPD)

A. Provide surge protective devices (SPD) as specified in Specification Section 16418.

Part 3 - Execution

I. EXAMINATION

A. Receive, inspect, handle, and store switchboards according to NEMA PB 2.1.

B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.

C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

II. INSTALLATION

A. The switchboard shall be installed in accordance with the manufacturer's recommendations, as shown on the Drawings, and as required by the electric utility company serving this project.

B. Equipment Mounting: The Contractor shall furnish and install a four (4) inch high by six (6) inch greater all sides (except rear when the switchboard is mounted against a wall) concrete housekeeping pad for the switchboard. Ensure that the concrete pad is level and free of irregularities.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.

2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

4. Install anchor bolts to elevations required for proper attachment to switchboards

C. The assembly shall be provided with adequate lifting means and shall be capable of being moved into installation position and bolted directly to Contractor-supplied floor sills to be set level in concrete per manufacturer's recommendations. All necessary hardware to secure the assembly in place shall be provided by the Contractor.

D. Install units' plumb, level and rigid without distortion to the switchboard cubicles.

E. Switchboard wiring for factory mounted devices shall be installed complete at the factory and adequately bundled and protected. All conductors across hinges, and all conductors for interconnections between shipping units, shall be flexible.

F. Contractor shall install required safety labels.

III. START-UP SERVICE AND PERFORMANCE TEST

A. The manufacturer shall provide factory personnel to completely inspect and test the switchboard(s) for proper installation and operation of all equipment, at the time of system start-up. Testing shall include, but not be limited to, performance testing of the bolted pressure switch(es), circuit breakers, SPDs, metering, single phase protection, blown fuse protection, and ground fault protection systems and equipment.

B. All testing and start-up services shall be in the presence of the Engineer and the Contract Owners Technical Representative (COTR). The tests shall be as stated in the manufacturer's literature. One (1) copy of the tests results shall be submitted to the

Engineer and Owner for review.

C. The completed equipment grounding system shall be subjected to a metered test at the switchboard ground bar to ensure that the ground resistance, without chemical treatment or other artificial means, does not exceed five (5) ohms. One copy of the test results shall be submitted to the Engineer and Owner for review.

D. Check tightness of all accessible mechanical and electrical connections to assure they are torqued to the minimum acceptable manufacturer's recommendations.

E. Check the switchboard for proper grounding, fastening and alignment.

IV. FIELD ADJUSTMENTS

A. This Contractor shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. Necessary field settings of devices and adjustments and minor modifications to equipment shall be carried out by this Contractor at no additional cost to the Owner.

B. The settings shall be in accordance with the approved protective device coordination study or as directed by the Engineer.

V. TRAINING

A. This Contractor shall provide eight (8) hours of technical service training to the Owner's technical and maintenance staff.

B. The training session shall be conducted by a manufacturer's qualified representative. The training program shall consist of instruction on operation of the assembly, circuit breakers, fused switches, metering, and major components within the assembly.

VI. CLEANING

A. Remove debris from switchboard and wipe dust and dirt from all components.

B. Repaint marred and scratched surfaces with touch-up paint to match original finish.

VII. RISER DIAGRAM

A. This Contractor shall furnish one (1) set of the complete as-built power riser diagram showing all switchboards, panelboards, emergency electrical power system equipment, and their interconnections. The riser diagram shall be laminated and mounted by this Contractor as directed by the Owner at the location of the main distribution switchboard.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work under this Section shall include furnishing and installing a complete distribution switchboard(s) as shown on the Drawings and herein specified.

A. Section Includes:

1. Service and distribution switchboards rated 600 V and less.

III. QUALITY ASSURANCE

A. All equipment, materials, and their installation shall conform to the requirements of the National Electrical Code (NEC), local code requirements, and these Specifications.

B. All equipment and material shall be listed by Underwriter's Laboratories, Inc. (UL) for their intended use and shall bear the UL label. Comply with UL 891.

C. Equipment shall be constructed in accordance with National Electrical Manufacturer's Association (NEMA) standards.

D. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.

E. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

F. Submittals are required in accordance with SECTION 16010 of these Specifications. The manufacturer shall furnish printed product data and also provide drawings to include components, materials, finishes, detailed plan and elevation views, required conduit rough-in openings, anchors, accessories, and wiring diagrams. Submittals shall also include, but not be limited to the following:

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.

2. Detail enclosure types for types other than NEMA 250, Type 1.

3. Detail bus configuration, current, and voltage ratings

1. Lug sizes.

2. Bus arrangements with all ampere ratings noted.

3. Type and spacing of bus supports.

4. Maximum short-circuit bracing.

5. Fusible switch units size, interrupting rating, and fuse rating.

6. Circuit breaker trip ratings and frame sizes.

7. Circuit breaker and fusible switch units arrangements.

8. Detail utility company's metering provisions with indication of approval by utility company.

9. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

10. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards.

11. Include schematic and wiring diagrams for power, signal, and control wiring.

12. The results of coordination and short circuit study shall apply for all switchboards prior to submission.

13. Overall dimensions.

14. Provisions for future.

15. Metering.

16. Wiring diagrams for the single-phase protection, blown fuse protection, and ground fault protection systems.

17. Surge protective devices when SPDs are integral with the switchboard. Provide submittals as described in Section 16418.

B. The distribution switchboard's utility metering provisions shall be constructed to comply with all of the electric utility company's requirements.

C. The distribution switchboard(s) shall be factory engineered and shall be a completely assembled unit, complete as shown on the Drawings and/or herein specified with provisions for electric utility company's metering equipment where required.

1.2 DELIVERY, STORAGE AND HANDLING

A. Deliver material and products in factory labeled packages. Store and handle in strict compliance with manufacturer’s instructions and recommendations.

B. Each switchboard section shall be delivered in individual shipping splits and

individually wrapped for protection and mounted on shipping skids.

C. Store in a clean, dry space. Maintain factory protection and /or provide an additional heavy canvas or heavy plastic cover to protect structure from dirt, water, construction debris, and traffic. Where applicable, provide adequate heating within enclosures to prevent condensation.

D. Handle in accordance with NEMA PB2.1 and manufacturer's written instructions. Lift only by lifting means provided for this express purpose. Handle carefully to avoid damage to switchboard internal components, enclosure and finish.

1.3 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above switchboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not exceeding 104 deg F
b. Altitude: Not exceeding 6600 feet

B. Service Conditions: NEMA PB 2, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet

Part 2 - Products

I. MANUFACTURERS

A. The distribution switchboard(s) shall be as manufactured by CUTLER-HAMMER, GENERAL ELECTRIC, SIEMENS, or SQUARE D.

B. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum of ten (10) years.

II. MATERIALS AND COMPONENTS

A. Enclosure Construction:

1. The switchboard shall be of the modular type construction, constructed in accordance with the latest NEMA PB-2 and UL 891 standards with the required number of vertical sections bolted together to form one metal enclosed rigid switchboard. Enclosure construction shall be NEMA 1 indoor. Service entrance switchboards shall be suitable for use as service equipment and be labeled in accordance with UL requirements.

2. The switchboard framework shall be fabricated on a dieformed steel base or base assembly consisting of formed steel channel welded or bolted together to rigidly support the entire shipping unit for moving on rollers and floor mounting. The framework shall be formed code gauge steel, rigidly welded and bolted together to support all cover plates, bussing, and component devices during shipment and installations.

3. Each switchboard section shall have an open bottom and individual removable top plate for installation and termination of conduits. The sides, top and rear shall be covered with removable screw-on code gauge steel plates. All edges of front covers or hinged front panels shall be formed. Provide adequate ventilation within the enclosure.

4. The switchboard shall include all protective devices, provision only spaces for future protective devices, and equipment as listed on the Drawings and specified herein with necessary interconnections, instrumentation and control wiring.

5. Top and bottom conduit area(s) shall be clearly shown and dimensioned on the shop drawings. The wireway front covers shall be hinged to permit access to the branch overcurrent protective device load side terminals without removing the covers.

6. All sections of the switchboard shall be rear aligned as shown on the Drawings. All protective devices shall be group mounted. Protective devices shall be front removable and load connections front accessible enabling the switchboard to be mounted against a wall. All sections of the switchboard shall also be front aligned unless specifically shown otherwise on the drawings.

7. The switchboard shall have fully equipped provision spaces for future protective devices as shown on the Drawing. Remaining space not identified on the Drawings shall be fully bussed and pre-drilled for future protective devices that do not have established frame sizes. This is in addition to the scheduled space or spare branches specified or shown on the Drawings.

B. Bus Requirements:

1. Switchboard bussing shall be rigid bus bars of silver-plated copper having ninety-eight (98) percent conductivity and shall be rated for a minimum of one

(1) square inch per one thousand (1,000) ampere capacity with a maximum average temperature rise sized for UL at sixty-five (65) degrees C.

2. The bus bars shall be rigidly braced to comply with the integrated equipment rating of the switchboard. The neutral bus shall be full capacity and sized as shown on the Drawings. The main horizontal bus bars between sections shall be full size, non-tapered for the complete length of the switchboard and located to permit a maximum of available conduit area. The through bus on the end section shall be extended and pre- drilled to allow the addition of future sections. The bus bar supports, connections, and joints are to be bolted with Grade five (5) carriage bolts and conical spring-type (Belleville) washers. All hardware used on conductors shall be high-tensile strength and zinc-plated.

3. A ground bus and lug shall be furnished firmly secured to each vertical section structure and shall extend the entire length of the switchboard. Provisions for the addition of future switchboard sections shall be provided. The manufacturer shall furnish a bus bond between the neutral and ground bus bars.

4. Ground Bus: 1/4-by-2-inch-hard-drawn copper of 98 percent conductivity, equipped with compression connectors for feeder and branch-circuit ground conductors.

5. The manufacturer shall furnish a 1/16-inch-thick plastic mimic bus of a contrasting color. Tape will not be acceptable.

6. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with compression connectors for outgoing circuit neutral cables.

C. Wiring/Terminations:

1. Small wiring, necessary fuse blocks and terminal blocks within the switchboard shall be furnished as required. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer’s wiring diagrams.

2. Mechanical-type terminals shall be provided for all line and load terminations suitable for copper or aluminum cable rated for 75 degrees C of the size as indicated on the Drawings.

3. Lugs shall be provided in the incoming line section for connections of the main grounding conductor. Additional lugs for connection of other grounding conductors shall be provided as indicated on the Drawings.

4. All control wiring shall be type SIS, bundled and secured with nylon ties. Insulated locking spade terminals shall be provided for all control connections, except where saddle type terminals are provided integral to a device. All current transformer secondary leads shall first be connected to conveniently

accessible short-circuit terminal blocks before connecting to any other device. All groups of control wires leaving the switchboard shall be provided with terminal blocks with suitable numbering strips. Provide wire markers at each end of all control wiring.

D. Ratings: The switchboard's system voltage and amperage shall be as indicated on the Drawings. The switchboard, as a complete unit, shall be given a single integrated equipment rating by the manufacturer of 65,000 amperes minimum or as determined by the Short-Circuit Coordination Study whichever is higher and shall be so labeled. Such rating shall be established by actual tests by the manufacturer on similar equipment available and shall be furnished with the submittal.

E. Incoming Service:

1. The utility metering compartment (C/T cabinet) shall also serve as the incoming service entrance compartment. Suitable compression lugs in the quantity and size required to terminate incoming utility service entrance cables shall be provided in accordance with the Contract Drawings and the requirements of the local electric utility company. Bus work shall include provisions for mounting utility company current transformers and potential transformers or potential taps as required by the utility company. Provide service entrance label and provide necessary applicable service entrance features per NEC and local code requirements.

2. The C/T cabinet shall be an integral part of the switchboard, complete with a barrier to separate the utility metering compartment from the rest of the switchboard. It shall be of the height necessary, and meet all other requirements of the electric utility company. The entire cabinet shall have a double hinged door with sealable hasp and knurled captive screws.

3. A separate incoming cable pull section shall not be required.

F. Fire Pump Tap: A fire pump tap section shall be provided as integral part of the switchboard. It shall be on the line side of the main disconnecting devices of the switchboard and contain only through bus and tap lugs to feed the fire pump.

G. Bolted Pressure Switches:

1. All main switches indicated on the Drawings 800 amperes and larger shall be true bolted contact load-break type with provisions for NEMA Class L fuses (fuses shall be furnished and installed by this Contractor). The stored energy deadfront operating mechanism shall include disk springs, compressed and released by the operating handle, to provide quick-positive switching action independent of the speed with which it is operated. The mechanism shall be designed so that the switch can be closed only after the opening spring has been charged, ready for electrical opening by solenoid or manual opening by mechanical pushbutton.

2. The operating handle shall be mechanically interlocked with the fuse access door and have provisions for padlocking in the OPEN position. An external mechanical flag shall be provided to identify whether the switch is either open

or closed.

3. Switches, with Class L fuses installed, shall be rated for use on systems capable of withstanding and closing into circuits having available fault currents of 200,000 RMS symmetrical amperes at 600 VAC maximum. Switches shall have an interrupting rating of twelve (12) times the continuous rating at 240, 480, and 600 VAC and capable of carrying 100% of rated current and shall have been tested in accordance with UL Subject 977. Switches shall have power terminals to accommodate either cable or bolted bus connections. Cable lugs, when used, shall be rated for use with 90 degrees C wire insulation (sized according to the 75-degree C temperature rating in the NEC). High-pressure contact switches do not meet the intent of these specifications.

4. The switch shall be complete with single phase protection to open the main device upon loss of any single phase but not upon simultaneous loss of all three (3) phases.

5. The switch shall be complete with separate blown fuse protection to open the main bolted pressure switch if one (1) or more of the Class L fuses operate.

6. The switch shall have two (2) sets of auxiliary contacts (2 normally open and 2 normally closed) for switch position monitoring.

7. Switch(es) shall be PRINGLE type CBC or approved equal.

H. Ground Fault Protection:

1. A zero-sequence type ground fault protection system shall be included for each main bolted pressure service switch as shown on the Drawings or as required by NEC. It shall consist of a current sensor enclosing all phase and neutral conductors of the circuit to be monitored, and appropriate relaying equipment to provide the desired ground fault current sensitivity and time-current response characteristics. The main switch shall be equipped to function in conjunction with the other elements of the ground fault protection system. Installation of the equipment shall be in all respects in accordance with the manufacturer's recommendations.

2. A current sensor shall be provided of the size necessary to encircle the phase conductors and the neutral conductor of the circuit to be monitored. Current sensor output shall be coordinated with the required input to the relay. A test winding shall be included to simulate the flow of ground fault current through the current sensor in order to test the operation of the ground fault protection system including sensor pick-up relay, and circuit protective device operation. The frame of the current sensor shall be so constructed that one leg can be opened to allow removal of installation around cable or bus without disturbing the cable or requiring drop-links in the bus.

3. The ground fault relay shall be of solid state construction, except that a coil operated output relay shall be provided to control 120-volt power to operate the associated fusible bolted pressure switch ground fault trip mechanism. The relay shall require 120-volt power to operate the associated main device.

Adjustable pickup current sensitivity for ground currents from 200 amperes to 1200 amperes shall be provided. A calibrated dial shall be provided for setting the current pickup point in the field. Settings for individual relays shall be 1200 amperes or as determined by the Short-Circuit Coordination Study whichever is lower. Time delay provided by the relay circuitry shall be nominally 0.2 seconds or as determined by the Short-Circuit Coordination Study and shall be permanently calibrated. A self-contained test circuit utilizing the test coil provided in the current sensor shall be incorporated in the system. The test circuit shall be part of the monitor panel that shall be mounted on the front cover of the switchboard.

I. Fusible Switches: Main switches 600 amperes and smaller and feeder protective devices shall consist of fusible switch units as indicated on the Drawings. The fusible switch units shall be quick-make, quick-break type. The units shall be listed by UL for service entrance use. The fusible switch units shall be group mounted in panel-type construction. Each unit shall be enclosed in a separate steel enclosure. The enclosure shall employ a hinged cover for access to the fuses which shall be interlocked with the operating handle to prevent opening the cover when the switch is in the ON position. This interlock shall be constructed so that it can be released with a standard electrician's tool for testing fuses without interrupting service. The units shall have padlocking provisions in the OFF position and the operating handle position shall give switch position indication, i.e., horizontal OFF, diagonal ON. This Contractor shall furnish and install BUSSMANN "LIMITRON", or approved equal, dual element fuses of the ratings noted on the Drawings.

J. Molded Case Circuit Breakers:

1. Feeder protective devices shall consist of molded case circuit breakers as indicated on the Drawings, equipped with individually insulated, braced, and protected connectors. The front faces of all circuit breakers shall be flush with each other.

2. The circuit breakers shall be operated by a toggle type handle and shall have a quick-make, quick-break over-center switching mechanism that shall be mechanically trip free from the handle so that the contacts cannot be held closed against short circuits and abnormal currents. Tripping due to overload or short circuit shall be clearly indicated by the handle automatically assuming a position midway between the manual "ON" and "OFF" positions. All latch surfaces shall be ground and polished. All poles of a multi-pole breaker shall be so constructed that they open, close, and trip simultaneously.

3. The circuit breakers shall be completely enclosed in a molded case. Non-interchangeable trip breakers shall have their covers sealed; interchangeable trip breakers shall have the trip unit sealed to prevent tampering. Ampere ratings shall be clearly visible. Contacts shall be non-welding silver alloy. Arc extinction shall be accomplished by means of arc chutes consisting of metal grids mounted in an insulating support. Breakers shall be of the bolt-on or I-Line type; plug-in, plug-on, and clamp-on circuit breakers shall not be acceptable.

4. Circuit breakers shall be 80% rated unless indicated on the Drawings to be 100% rated.

5. Circuit breakers shall have a minimum symmetrical interrupting capacity as indicated on the Drawings. The interrupting ratings of the circuit breakers shall be at least equal to, or greater than, the available short circuit at the line terminals and not less than those values shown on the Drawings and specified in this specification section or as determined by the Short-Circuit Coordination Study whichever is higher.

6. Circuit breakers shall be listed with UL, conform to the applicable requirements of the latest issue of NEMA Standards Publication No. AB1.

7. Circuit breaker frames 250 ampere and below shall have thermal- magnetic trip units, with inverse time-current characteristics, unless otherwise indicated on the Drawings.

    a) Automatic operation of all circuit breakers shall be obtained by means of thermal-magnetic tripping devices located in each pole providing inverse time delay and instantaneous circuit protection.

    b) Circuit breaker frames shall be ambient compensating in that, as the ambient temperature increases over 40 C, the circuit breaker automatically derates itself to better protect its associated conductor.

    c) Thermal-magnetic circuit breakers 250A and above shall have thermal magnetic interchangeable trip units, unless otherwise indicated on the Drawings.

8. Circuit breaker frames 400 ampere and above shall have microprocessor-based RMS sensing trip units, unless otherwise indicated on the Drawings.

    a) Solid State sensing shall measure true RMS current with capability to measure through to the 21st harmonic. Automatic operation of all circuit breakers shall be obtained by means of
        solid state tripping elements providing inverse time delay and instantaneous and short-time circuit protection. Continuous current rating shall be adjustable from 20% to 100% of trip unit rating. Long-time delay and instantaneous trip ratings shall also be adjustable. The short time pick-up trip shall have adjustable pick-up settings at definite times and with I2t delay.

    b) Longtime current adjustment shall be possible without the need for a rating plug.

    c) Feeder circuit breakers shall be provided with integral ground fault protection. Ground fault pick-up shall be adjustable from 20% to 70% of the breakers maximum continuous current rating, but in no case, be greater than 1200A. Ground fault time delay shall be adjustable with three (3) I2t delay settings.

d) Solid State circuit breakers shall have built-in test ports for testing the long-time delay, instantaneous, and ground fault functions of the breaker by means of a test set.

e) Provide a test set capable of testing all circuit breakers with a built-in test port.

9. Circuit breaker accessories: Provide shunt trips, bell alarms and auxiliary switches, etc. as may be shown on the drawings. All accessories shall be UL Listed for field installation.

10. Circuit breakers shall be manufactured by the same manufacturer as the switchboard and factory installed.

11. Where indicated, circuit breakers shall be UL listed for series application.

12. Large permanent individual circuit numbers shall be affixed to each breaker in a uniform position.

K. Nameplates:

1. Each device installed in the switchboard (including the C/T cabinet) shall be identified with a suitable nameplate, engraved as indicated on the Drawings. Nameplates shall be white phenolic with engraved black letters not less than 3/8" block style. The emergency service nameplates shall be red with white letters. Nameplates shall be screw fastened.

2. Furnish master nameplate giving switchboard designation, voltage and ampere rating, short-circuit rating, manufacturer's name, general order number, and item number.

L. All exterior and interior steel surfaces of the switchboard shall be properly cleaned and provided with a rust-inhibiting phosphatized coating. Color and finish of the switchboard shall be ANSI 61 gray.

III. METERING

A. A separate digital meter shall be panel mounted in the front face of the switchboard. The information and capabilities provided by the meter shall include, but not be limited to the following:

1. Current (amperes) per phase.

2. Voltage, phase-to-phase and phase-neutral.

3. Real Power (kW), per phase and three phase total.

4. Reactive Power (kVAR), per phase and three phase total.

5. Apparent Power (kVA), per phase and three phase total.

6. Power Factor (true), per phase and three phase total.

7. Frequency readings.

8. Real Energy (kWh), three phase total.

9. Reactive Energy (kVARh), three phase total.

10. Apparent Energy (kVAh), three phase total.

11. Energy Accumulation modes, signed, absolute, energy in, energy out.

12. Neutral current measurements.

13. Demand Current, per phase and neutral, present and peak.

14. Real Power Demand (kWd) readings, three phase total, present and peak.

15. Reactive Power Demand (kVARd) readings, three phase total, present and peak.

16. Apparent Power Demand (kVAd) readings, three phase total, present and peak.

17. Total Harmonic Distortion (THD) readings, voltage and current, per phase, provided as individual harmonic magnitudes up to the 31st harmonic, and as total odd, total even and total overall harmonic distortion; all readings given as a percentage of fundamental.

18. Date and Time Stamping, peak demands, power up/restart and resets.

19. Onboard Alarms for over/under voltages (per phase L-L, L-N), and voltage unbalance.

20. Minimum and Maximum readings.

B. The meter shall be accurate to 0.25% of readings plus 0.05% of full scale for voltage and current sensing, and 0.5% of reading plus 0.05% of full scale for power and energy, accurate through the 31st harmonic.

1. These accuracies shall be maintained for both light and full loads.

2. No annual re-calibration by users shall be required to maintain these accuracies.

3. Voltage and current for all phases shall be sampled simultaneously to assure high accuracy.

C. The meter shall be provided with a Modbus RTU serial or Modbus-TCP Ethernet communications port for open protocol integration of the electrical data into the BAS.

The Meter manufacturer shall provide all register data and support to the BAS Integrator onsite to provide a seamless integration of the data into the BAS.

D. The meter data communications shall be optically isolated to provide reliable operation.

E. The meter shall be equipped with backlit, two-line or greater LCD display.

F. All meter setup information and reset commands shall be password protected.

G. The meter shall have a KYZ pulse initiator for communication of kWh, kVARh, or kVAh information to third party energy management systems shall be provided.

H. Metering transformers shall be provided to support the requirements of the meters specified herein, UL listed or recognized.

IV. SURGE PROTECTIVE DEVICE (SPD)

A. Provide surge protective devices (SPD) as specified in Specification Section 16418.

Part 3 - Execution

I. EXAMINATION

A. Receive, inspect, handle, and store switchboards according to NEMA PB 2.1.

B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.

C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

II. INSTALLATION

A. The switchboard shall be installed in accordance with the manufacturer's recommendations, as shown on the Drawings, and as required by the electric utility company serving this project.

B. Equipment Mounting: The Contractor shall furnish and install a four (4) inch high by six (6) inch greater all sides (except rear when the switchboard is mounted against a wall) concrete housekeeping pad for the switchboard. Ensure that the concrete pad is level and free of irregularities.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.

2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

4. Install anchor bolts to elevations required for proper attachment to switchboards

C. The assembly shall be provided with adequate lifting means and shall be capable of being moved into installation position and bolted directly to Contractor-supplied floor sills to be set level in concrete per manufacturer's recommendations. All necessary hardware to secure the assembly in place shall be provided by the Contractor.

D. Install units' plumb, level and rigid without distortion to the switchboard cubicles.

E. Switchboard wiring for factory mounted devices shall be installed complete at the factory and adequately bundled and protected. All conductors across hinges, and all conductors for interconnections between shipping units, shall be flexible.

F. Contractor shall install required safety labels.

III. START-UP SERVICE AND PERFORMANCE TEST

A. The manufacturer shall provide factory personnel to completely inspect and test the switchboard(s) for proper installation and operation of all equipment, at the time of system start-up. Testing shall include, but not be limited to, performance testing of the bolted pressure switch(es), circuit breakers, SPDs, metering, single phase protection, blown fuse protection, and ground fault protection systems and equipment.

B. All testing and start-up services shall be in the presence of the Engineer and the Contract Owners Technical Representative (COTR). The tests shall be as stated in the manufacturer's literature. One (1) copy of the tests results shall be submitted to the Engineer and Owner for review.

C. The completed equipment grounding system shall be subjected to a metered test at the switchboard ground bar to ensure that the ground resistance, without chemical treatment or other artificial means, does not exceed five (5) ohms. One copy of the test results shall be submitted to the Engineer and Owner for review.

D. Check tightness of all accessible mechanical and electrical connections to assure they are torqued to the minimum acceptable manufacturer's recommendations.

E. Check the switchboard for proper grounding, fastening and alignment.

IV. FIELD ADJUSTMENTS

A. This Contractor shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. Necessary field settings of devices and adjustments and minor modifications to equipment shall be carried out by this Contractor at no additional cost to the Owner.

B. The settings shall be in accordance with the approved protective device coordination study or as directed by the Engineer.

V. TRAINING

A. This Contractor shall provide eight (8) hours of technical service training to the Owner's technical and maintenance staff.

B. The training session shall be conducted by a manufacturer's qualified representative. The training program shall consist of instruction on operation of the assembly, circuit breakers, fused switches, metering, and major components within the assembly.

VI. CLEANING

A. Remove debris from switchboard and wipe dust and dirt from all components.

B. Repaint marred and scratched surfaces with touch-up paint to match original finish.

VII. RISER DIAGRAM

A. This Contractor shall furnish one (1) set of the complete as-built power riser diagram showing all switchboards, panelboards, emergency electrical power system equipment, and their interconnections. The riser diagram shall be laminated and mounted by this Contractor as directed by the Owner at the location of the main distribution switchboard.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work under this Section shall include furnishing and installing a complete generator quick connection switchboard(s), utilizing a main circuit protective device, generator lug and receptacle connections as shown on the Drawings and herein specified.

III. QUALITY ASSURANCE

A. All equipment, materials, and their installation shall conform to the requirements of the National Electrical Code (NEC), local code requirements, and these Specifications.

B. All equipment and material shall be listed by Underwriter's Laboratories, Inc. (UL) for their intended use and shall bear the UL label.

C. Equipment shall be constructed in accordance with National Electrical Manufacturer's Association (NEMA) standards.

D. Submittals are required in accordance with Division 1 of these Specifications. The manufacturer shall furnish printed product data and also provide drawings to include components, materials, finishes, detailed plan and elevation views, required conduit rough-in openings, anchors, pad accessories, wiring diagrams, key interlock scheme drawings and sequence of operations. Submittals shall also include, but not be limited to the following:

1. Lug sizes.
2. Bus arrangements with all ampere ratings noted.
3. Type and spacing of bus supports.
4. Maximum short-circuit bracing.
5. Circuit breaker trip ratings and frame sizes.
6. Circuit breaker arrangements.
7. Overall dimensions.
8. Metering.

9. Surge protective devices when SPDs are integral with the switchboard. Provide submittals as described in Section 16418.

10. Wiring diagrams for the single-phase protection and ground fault protection systems.

E. The generator quick connection switchboard(s) shall be factory engineered and shall be a completely assembled unit, complete as shown on the Drawings and/or herein specified.

F. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

G. The manufacturer shall be ISO 9001 or 9002 certified for the equipment specified herein.

IV. DELIVERY, STORAGE AND HANDLING

A. Deliver material and products in factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations.

B. Each switchboard section shall be delivered in individual shipping splits and individually wrapped for protection and mounted on shipping skids.

C. Store in a clean, dry space. Maintain factory protection and /or provide an additional heavy canvas or heavy plastic cover to protect structure from dirt, water, construction debris, and traffic. Where applicable, provide adequate heating within enclosures to prevent condensation.

D. Handle in accordance with NEMA PB2.1 and manufacturer's written instructions. Lift only by lifting means provided for this express purpose. Handle carefully to avoid damage to switchboard internal components, enclosure and finish.

Part 2 - Products

I. MANUFACTURERS

A. The generator quick connection switchboard(s) shall be as manufactured by CUTLER-HAMMER, GENERAL ELECTRIC, SIEMENS, or SQUARE D.

B. The listing of specific manufacturers does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed are not relieved from meeting these specifications in their entirety.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum of ten (10) years.

II. MATERIALS AND COMPONENT

A. Construction:

1. The generator quick connection switchboard shall be of the modular type construction, constructed in accordance with the latest NEMA PB-2 and UL 891 standards with the required number of vertical sections bolted together to form one metal enclosed rigid switchboard. The sides and rear shall be covered with removable bolt-on covers. All edges of front covers and hinged front panels shall be formed. Provide adequate ventilation within the enclosure.

2. All sections of the switchboard shall be front and rear aligned as shown on the Drawings with depth as required by the manufacturer with all code required clearances maintained. All protective devices shall be grouped mounted. Devices shall be front removable and load connections front accessible enabling switchboard to be mounted against a wall.

3. The switchboard shall be provided with load connection options to cross bus or mechanical outgoing cable terminations, which shall be suitable for copper or aluminum conductors.

4. The assembly shall be provided with adequate lifting means.

5. The switchboard framework shall be fabricated on a dieformed steel base or base assembly consisting of formed steel channel welded or bolted together to rigidly support the entire shipping unit for moving on rollers and floor mounting. The framework shall be formed code gauge steel, rigidly welded and bolted together to support all cover plates, bussing, and component devices during shipment and installations.

6. Top and bottom conduit area(s) shall be clearly shown and dimensioned on the shop drawings.

B. Enclosure construction shall be NEMA Type 1 indoor.

C. Enclosure construction shall be NEMA Type 3R outdoor.

1. Outdoor enclosure shall be non-walk-in and meet applicable NEMA 3R UL requirements.

2. Enclosure shall have a flat roof.

3. Provide hinged cable entry trap door to allow cable access to generator connection receptacles and lugs while maintaining Type 3R Enclosure integrity.

4. The enclosure shall be provided with bolt-on rear covers for each

section.

5. Doors shall have provisions for pad locking.

6. Ventilating openings shall be provided.

7. The outdoor enclosure shall be provided with a space heater having adequate wattage to prevent the accumulation of moisture and shall be thermostatically controlled. Power for the space heater shall be obtained from a source as indicated on the Drawings. Supply voltage shall be 120 volts AC.

D. Bus Requirements:

1. Switchboard bussing shall be rigid bus bars of silver-plated copper having ninety-eight (98) percent conductivity and shall be rated for a minimum of one (1) square inch per one thousand (1,000) ampere capacity with a maximum average temperature rise sized for UL at sixty-five (65) degrees C; Over a forty (40) degrees C ambient (outside the enclosure).

2. The bus bars shall be rigidly braced to comply with the integrated equipment rating of the switchboard. The neutral bus shall be full capacity and sized as shown on the Drawings. The bus bar supports, connections, and joints are to be bolted with grade five (5) carriage bolts and Belleville washers.

3. A ground bus and lug shall be furnished firmly secured to each vertical section structure and shall extend the entire length of the switchboard.

E. Wiring/terminations:

1. The switchboard shall be provided with both mechanical lugs and cam- type receptacle assembly for connection of generator power phases (A, B, C), neutral and grounding conductors. All connections for phases, neutral, ground, etc., shall be clearly marked via labeling.

2. Each single pole cam-type receptacle shall be rated for no less than 400 amps at 90 degrees C. Multiple receptacles per phase, neutral and ground shall be utilized when amperages over 400 are requested. Contact material of the receptacle shall be composed of brass.

3. Cam-type receptacles shall be male type, unless otherwise directed by the Owner, and must be suitable for use in outdoor environments.

4. Single pole Cam-type receptacles shall be UL 498 listed for Attachment Plugs and Receptacles and UL 1691.

5. Small wiring, necessary fuse blocks and terminal blocks within the

switchboard shall be furnished as required. Control components mounted within the assembly, such as fuse blocks, relays pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams.

6. Where applicable all control wire shall be type SIS, bundled and secured with nylon ties. Insulated locking spade terminals shall be provided integral to a device. All current transformer secondary leads shall first be connected to conveniently accessible short-circuit terminal blocks before connection to any other device. All groups of control wires leaving the switchboard shall be provided with terminal blocks with suitable numbering strips. Provide wire markers at each end of all control wiring.

F. Ratings: The switchboard's system voltage and amperage shall be as indicated on the Drawings. The switchboard, as a complete unit, shall be given a single integrated equipment rating by the manufacturer of 65,000 amperes minimum or as determined by the Short-Circuit Coordination Study whichever is higher and shall be so labeled. Such rating shall be established by actual tests by the manufacturer on similar equipment available and shall be furnished with the submittal.

G. Main Protective Device:

1. Main protective device shall consist of a molded case circuit breaker as indicated on the Drawings, equipped with individually insulated, braced, and protected connectors, and single phase protection.

2. The circuit breaker shall be operated by a toggle type handle and shall have a quick-make, quick-break over-center switching mechanism that shall be mechanically trip free from the handle so that the contacts cannot be held closed against short circuits and abnormal currents. Tripping due to overload or short circuit shall be clearly indicated by the handle automatically assuming a position midway between the manual "ON" and "OFF" positions. All latch surfaces shall be ground and polished. All poles of a multi-pole breaker shall be so constructed that they open, close, and trip simultaneously.

3. The circuit breaker shall be completely enclosed in a molded case. Non- interchangeable trip breaker shall have the cover sealed; interchangeable trip breaker shall have the trip unit sealed to prevent tampering. Ampere ratings shall be clearly visible. Contacts shall be non-welding silver alloy. Arc extinction shall be accomplished by means of arc chutes consisting of metal grids mounted in an insulating support. Breaker shall be of the bolt-on type; plug-in, plug-on, blow-on, and clamp-on circuit breakers shall not be acceptable.

4. Circuit breakers shall be 80% rated unless indicated on the Drawings to be 100% rated.

5. Circuit breaker shall have a minimum symmetrical interrupting capacity of 65,000 amperes. The interrupting ratings of the circuit breaker shall be at least equal to, or greater than, the available short circuit at the line terminals and not less than those values shown on the Drawings and specified in this specification section or as determined by the Short-Circuit Coordination Study whichever is higher.

6. Circuit breaker shall be listed with UL, conform to the applicable requirements of the latest issue of NEMA Standards Publication No. AB1.

7. Circuit breaker frames 250 ampere and below shall have thermal-magnetic trip units, with inverse time-current characteristics, unless otherwise indicated on the Drawings.

   a) Automatic operation of all circuit breakers shall be obtained by means of thermal-magnetic tripping devices located in each pole providing inverse time delay and instantaneous circuit protection.

   b) Circuit breaker frames shall be ambient compensating in that, as the ambient temperature increases over 40 C, the circuit breaker automatically derates itself to better protect its associated conductor.

   c) Thermal-magnetic circuit breakers 250A and above shall have thermal magnetic interchangeable trip units, unless otherwise indicated on the Drawings.

8. Circuit breaker frames 400 ampere and above shall have microprocessor-based RMS sensing trip units, unless otherwise indicated on the Drawings.

   a) Solid State sensing shall measure true RMS current with capability to measure through to the 21st harmonic. Automatic operation of all circuit breakers shall be obtained by means of solid state tripping elements providing inverse time delay and instantaneous and short-time circuit protection. Continuous current rating shall be adjustable from 20% to 100% of trip unit rating. Long-time delay and instantaneous trip ratings shall also be adjustable. The short time pick-up trip shall have adjustable pick-up settings at definite times and with I2t delay.

   b) Longtime current adjustment shall be possible without the need for a rating plug.

c) Feeder circuit breakers shall be provided with integral ground fault protection. Ground fault pick-up shall be adjustable from 20% to 70% of the breakers maximum continuous current rating, but in no case, be greater than 1200A. Ground fault time delay shall be adjustable with three (3) I2t delay settings.

d) Solid State circuit breakers shall have built-in test ports for testing the long-time delay, instantaneous, and ground fault functions of the breaker by means of a test set.

e) Provide a test set capable of testing all circuit breakers with a built-in test port.

9. Circuit breaker accessories: In addition to single-phase protection, provide shunt trips, bell alarms and auxiliary switches, etc. as may be shown on the Drawings. All accessories shall be UL Listed for field installation.

10. Circuit breaker shall be manufactured by the same manufacturer as the switchboard and factory installed.

11. Where indicated, circuit breakers shall be UL listed for series application.

H. Provide Key interlocks between Generator Switchboard Main and Normal source breaker to prevent inadvertent interconnections and utility back feed or paralleling of unsynchronized sources. Key interlocks shall be as manufactured by KIRK KEY INTERLOCK COMPANY.

I. All exterior and interior steel surfaces of the switchboard shall be properly cleaned and provided with a rust-inhibiting phosphatized coating. Color and finish of the switchboard shall be ANSI 61 gray.

III. NAMEPLATES

A. Provide a switchboard designation engraved nameplate on the face of the switchboard. Each device installed in the switchboard shall be identified with a suitable nameplate, engraved as indicated on the Drawings. Engraved nameplates shall be white phenolic with engraved black letters not less than 3/8" block style. Each wiring termination assembly section shall also be identified with an engraved nameplate i.e.: QUICK CONNECT RECEPTACLES, GENERATOR INCOMING LUGS, GENERATOR BREAKER, etc.

B. Furnish a master nameplate giving switchboard designation, voltage ampere rating, short-circuit rating, manufacturer’s name, general order number, item number and other manufacturer’s required information.

C. Provide a set of permanent operating instructions affixed to the switchboard having simple instructions for operation. Through the inclusion of these instructions, any qualified generator technician can operate the mechanisms include in the assembly.

IV. SURGE PROTECTION DEVICE

A. Provide surge protective devices (SPD) as specified in Section 16418.

Part 3 - Execution

I. INSTALLATION

A. The switchboard shall be installed in accordance with the manufacturer's recommendations and as shown on the Drawings.

B. The Contractor shall furnish and install a four (4) inch high by six (6) inch greater all sides (except rear when the switchboard is mounted against a wall) concrete housekeeping pad for the switchboard.

C. The assembly shall be provided with adequate lifting means and shall be capable of being moved into installation position and bolted directly to Contractor-supplied floor sills to be set level in concrete per manufacturer's recommendations. All necessary hardware to secure the assembly in place shall be provided by the Contractor.

D. Install units' plumb, level and rigid without distortion to the switchboard cubicles.

E. Switchboard wiring for factory mounted devices shall be installed complete at the factory and adequately bundled and protected. All conductors across hinges, and all conductors for interconnections between shipping units, shall be flexible.

F. Contractor shall install required safety labels.

II. KEY INTERLOCKS

A. Key interlocks shall be factory installed in the Generator Quick Connect Switchboard. Key interlocks shall be factory or field installed in the "normal source" main protective devices and shall not void the UL Listing of the "normal source" protective device. If required, this Contractor shall have the "normal source" device manufacturer's authorized factory engineer or service technician install the Contractor provided key interlock switch.

B. The sequence of operation shall be such that there will be only one key for the interlock sequence. To insert or withdraw the key the protective device must be in the OPEN position with the interlock bolt engaged. To close the protective device the key must be inserted and turned within the lock to withdraw the interlock bolt allowing the protective device to CLOSE. When the protective device is in the CLOSED position the key cannot be removed until the protective device is once again in the OPEN position with the key turned to insert the interlock bolt, locking the device OPEN.

III. START-UP SERVICE AND PERFORMANCE TEST

A. The manufacturer shall provide factory personnel to completely inspect and test the

switchboard(s) for proper installation and operation of all equipment, at the time of system start-up. Testing shall include, but not be limited to, performance testing of the circuit breakers, TVSS, metering, single-phase protection, and ground fault protection systems and equipment.

B. All testing and start-up services shall be in the presence of the Engineer and the Contract Owners Technical Representative (COTR). The tests shall be as stated in the manufacturer's literature. One (1) copy of the tests results shall be submitted to the Engineer and Owner for review.

C. The completed equipment grounding system shall be subjected to a metered test at the switchboard ground bar to ensure that the ground resistance, without chemical treatment or other artificial means, does not exceed five (5) ohms. One (1) copy of the test results shall be submitted to the Engineer and Owner for review.

D. Check tightness of all accessible mechanical and electrical connections to assure they are torqued to the minimum acceptable manufacturer's recommendations.

E. Check the switchboard for proper grounding, fastening and alignment.

IV. FIELD ADMUSTMENTS

A. This Contractor shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. Necessary field settings of devices and adjustments and minor modifications to equipment shall be carried out by this Contractor at no additional cost to the Owner.

B. The settings shall be in accordance with the approved protective device coordination study or as directed by the Engineer.

V. TRAINING

A. This Contractor shall provide eight (8) hours of technical service training to the Owner's technical and maintenance staff.

B. The training session shall be conducted by a manufacturer's qualified representative. The training program shall consist of instruction on operation of the assembly, circuit breakers, metering, and major components within the assembly.

VI. CLEANING

A. Remove debris from switchboard and wipe dust and dirt from all components.

B. Repaint marred and scratched surfaces with touch-up paint to match original finish.

VII. RISER DIAGRAM

A. This Contractor shall furnish one (1) set of the complete as-built power riser diagram showing all switchboards, panelboards, emergency electrical power system equipment,

and their interconnections. The riser diagram shall be laminated and mounted by this Contractor as directed by the Owner at the location of the main distribution switchboard or the generator quick connect switchboard.

END OF SECTION

Distribution Panelboards Section 262416

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include furnishing and installing distribution panelboards complete for all systems as shown on the Drawings and herein specified.

III. SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.

2. Detail enclosure types and details for types other than NEMA 250, Type 1.

3. Detail bus configuration, current, and voltage ratings.

4. Short-circuit current rating of panelboards and overcurrent protective devices.

5. Include evidence of NRTL listing for series rating of installed devices.

6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

7. Include wiring diagrams for power, signal, and control wiring.

8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

9. The results of coordination and short circuit study shall be submitted along with

the submission.

C. Field Quality-Control Reports:

1. Test procedures used.

2. Test results that comply with requirements.

3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

D. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

E. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

IV. QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. All equipment, materials, and their installation shall conform to the requirements of the National Electrical Code (NEC), local code requirements, and these Specifications.

C. All equipment and materials shall be listed by Underwriter's Laboratories, Inc. (UL) for their intended use and shall bear the UL label.

D. Equipment shall be constructed in accordance with National Electrical Manufacturer's Association (NEMA) standards.

E. Submittals are required in accordance with SECTION 16010 of these Specifications. The manufacturer shall furnish, but not be limited to the following:

1. Circuit breaker and/or fusible switch layout with dimensions and nameplate designation.

2. Circuit breaker trip ratings and frame sizes.

3. Fusible switch units' size, interrupting rating, and fuse rating.

4. Component list.

5. Conduit entry/exit locations.

6. Assembly ratings, including short-circuit rating, voltage, and continuous current

rating.

7. Bus material, including ground bar.

8. Cable terminal sizes.

9. Product data for each type of panelboard.

V. DELIVERY, STORAGE AND HANDLING

A. Deliver material and products in factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations.

B. Each distribution panelboard section shall be delivered in individual shipping splits and individually wrapped for protection and mounted on shipping skids.

C. Store in a clean, dry space. Maintain factory protection and /or provide an additional heavy canvas or heavy plastic cover to protect structure from dirt, water, construction debris, and traffic. Where applicable, provide adequate heating within enclosures to prevent condensation.

D. Handle in accordance with NEMA PB1.1 and manufacturer's written instructions. Handle carefully to avoid damage to panelboard internal components, enclosure and finish.

VI. PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and

weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a) Ambient Temperature: Not exceeding 23 deg Fto plus 104 deg F.

b) Altitude: Not exceeding 6600 feet.

3. Service Conditions: NEMA PB 1, usual service conditions, as follows:

a) Ambient temperatures within limits specified.

b) Altitude not exceeding 6600 feet.

Part 2 - Products

I. GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Flush- and surface-mounted cabinets.

1. Rated for environmental conditions at installed location.

a) Indoor Dry and Clean Locations: NEMA 250, Type 1.

b) Outdoor Locations: NEMA 250, Type 3R.

c) Kitchen or Wash-Down Areas: NEMA 250, Type 4X.

d) Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

e) Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive

f) Liquids: NEMA 250, Type 12.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. 3. Finishes:

a) Panels and Trim: galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting

of prime coat and thermosetting topcoat.

4. Back Boxes: Galvanized steel.

5. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.

B. Incoming Mains Location: Top and/or bottom as determined by the contractor.

C. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.

2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

D. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.

2. Main and Neutral Lugs: Compression type.

3. Ground Lugs and Bus-Configured Terminators: Compression type.

4. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

5. Subfeed (Double) Lugs: Compression type suitable for use with conductor material.

6. Locate at same end of bus as incoming lugs or main device.

E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

II. MANUFACTURERS

A. The distribution switchboard(s) shall be as manufactured by CUTLER-HAMMER,

GENERAL ELECTRIC, SIEMENS, or SQUARE D.

III. PANELBOARDS

A. This Contractor shall furnish and install where indicated on the Drawings, deadfront distribution panelboards incorporating switching and branch circuit protective devices of the number, ratings, and type noted herein or as shown on the Drawings. Panelboards shall have NEMA 1 general purpose enclosures and shall be surface mounted. All distribution panelboards shall be rated for the intended voltage and shall be in accordance with UL's "Standard for Panelboards" and "Standard for Cabinets and Boxes" and shall be so labeled. Distribution panelboards shall also comply with NEMA "Standard PB1 For Panelboards" and the NEC. (Circuit breakers) (Switch and fuse units) shall conform to the paragraph, which follows in these Specifications.

B. Ratings:

1. Distribution panelboards rated 240 Vac or less shall have short-circuit ratings as shown on the Drawings or as determined by the Short- Circuit Coordination Study whichever is higher, but not less than 10,000-amperes RMS symmetrical.

2. Distribution panelboards rated 480 Vac shall have short-circuit ratings as shown on the Drawings or as determined by the Short-Circuit Coordination Study whichever is higher, but not less than 14,000- amperes RMS symmetrical.

3. Distribution panelboards used for service entrance shall have short-circuit ratings as shown on the Drawings or as determined by the Short- Circuit Coordination Study whichever is higher, but not less than 65,000 amperes RMS symmetrical at system voltage and be labeled as service entrance equipment in accordance with UL requirements.

4. Distribution panelboards shall have fully rated or series connected short-circuit rated interrupting ratings as indicated on the drawings and shall be labeled with a

UL short-circuit rating. When series connected ratings are applied with integral or remote upstream devices, a label shall be provided. It shall state the conditions of the UL series connected ratings including:

a) Size and type of upstream device.

b) Branch devices that can be used.

c) UL series short-circuit rating.

C. Interiors:

1. All interiors shall be completely factory assembled with switching and protective devices, wire connectors, etc. All conductor connectors, except screw terminals, shall be of the anti-turn solderless type and all shall be suitable for copper conductors of the sizes indicated

on the Drawings.

2. Interiors shall be designed so that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors and shall be so designed that circuits may be changed without matching, drilling, or tapping.

D. All distribution panelboards shall be surface mounted on twelve (12) gauge formed steel channel having a cross section dimension at least 1-1/2 inches x 1- 1/2 inches. The channel and fittings shall have a hot dipped galvanized finish to resist rust formation. Channels shall be installed vertically and as detailed on the Drawings.

E. Bus Bars:

1. Bus bars for the mains shall be of copper sized in accordance with UL 67 Standards for temperature rise to limit temperature rise on any current carrying part to a maximum of 65 degrees C above an ambient of 40 degrees C maximum. The bus bars shall be standard density rated for 1000 amperes per square inch copper. Bus bar taps for distribution panelboards with single pole branches shall be arranged for sequence phasing of the branch circuit devices. Busing shall be braced throughout to conform to industry standard practice governing short circuit stresses in panelboards. Phase busing shall be full height without reduction. Cross connectors shall be copper.

2. Phase busing shall be manufactured to accept bolt-on circuit protective devices only.

3. The distribution panelboard shall have fully equipped provision spaces for future protective devices as shown on the Drawings. Remaining space not identified on the Drawings shall be fully bused and pre-drilled for future protective devices that do not have established frame sizes. This is in addition to the scheduled space or spare branches specified or shown on the Drawings.

4. A non-insulated copper ground bus shall be provided for each distribution panelboard.

5. Full size (100% rated) insulated neutral busing shall be included for panelboards shown with a neutral. Neutral busing shall have a suitable lug for each outgoing feeder or branch circuit requiring a neutral connection.

6. Lugs shall be rated for 75 degrees C terminations and shall bolt in place.

F. Backboxes:

1. Backboxes shall be made from unpainted galvanized code gauge steel having no knockouts.

2. Boxes shall have gutter and wiring space sized as required per NEC but not less than four (4) inches on all sides.

3. Backboxes shall also have sufficient space to safely attach clamp-on or split-core current transformers to the feeders for future portable or permanent check metering.

4. Backboxes for multiple (two or more) sections shall be of the same dimensions.

5. Each backbox shall include at least four (4) interior mounting studs.

6. The distribution panelboard identification number shall be on the backbox.

G. Trim: 1. Distribution panelboards having individual switch and fuse units shall have hinged door trims which cover all live parts. Switching device handles shall be accessible. The use of door in a hinged cover type panelboard is prohibited.

2. Doors in distribution panelboard trims shall conform to the following:

a) In making device handles accessible, inboard doors shall not uncover any live parts. Outboard doors shall allow hinged access to the interior panel wiring without removal of the panel door assembly.

b) Doors shall have a semi-flush type cylinder lock and catch. Door hinges shall be concealed. Two (2) keys shall be furnished for each distribution panelboard door and all locks shall be keyed as requested by the Owner to match current standard. The outer door shall be keyed separately. Directory frame and card, having a transparent cover, shall be furnished on the inside of each door.

c) Directory cards shall be neatly typewritten indicating each branch circuit number and assignment. The assignment designation shall include the final room number(s) assigned by the Owner. Do not use the architectural room numbers shown on the Drawings. The directory cards shall also include the source (switchboard, panelboard, etc., with circuit number) feeding the panel.

3. The trims shall be fabricated from code gauge sheet steel.

4. All of the distribution panelboard's steel surfaces, exterior and interior shall be properly cleaned and finished with the manufacturer's standard paint over a rust-inhibiting phosphatized coating. The finish paint shall be of a type to which field applied paint will adhere.

5. Trims shall be mountable by a screwdriver without the need for special tools.

IV. CIRCUIT BREAKERS

A. Electrical circuits shall be protected by molded case circuit breakers as indicated on the Drawings.

B. The circuit breakers shall be operated by a toggle type handle and shall have a quick-make, quick-break over-center switching mechanism that shall be mechanically trip free from the handle so that the contacts cannot be held closed against short circuits and abnormal currents. Tripping due to overload or short circuit shall be clearly indicated by the handle automatically assuming a position midway between the manual "ON" and "OFF" positions. All latch surfaces shall be ground and polished. All poles of a multi-pole breaker shall be so constructed that they open, close, and trip simultaneously.

C. The circuit breakers shall be completely enclosed in a molded case. Non- interchangeable trip breakers shall have their covers sealed; interchangeable trip breakers shall have the trip unit sealed to prevent tampering. Ampere ratings shall be clearly visible. Contacts shall be non-welding silver alloy. Arc extinction shall be accomplished by means of arc chutes consisting of metal grids mounted in an insulating support. Breakers shall be of the bolt-on type; plug-in, plug-on, blow-on, and clamp-on circuit breakers shall not be acceptable.

D. Circuit breakers shall be 80% rated unless indicated on the Drawings to be 100% rated.

E. Circuit breakers shall have a minimum symmetrical interrupting capacity as indicated on the Drawings. The interrupting ratings of the circuit breakers shall be at least equal to, or greater than, the available short circuit at the line terminals and not less than those values shown on the Drawings and specified in this specification section or as determined by the Short-Circuit Coordination Study whichever is higher.

F. Circuit breakers shall be listed with UL, conform to the applicable requirements of the latest issue of NEMA Standards Publication No. AB1.

G. Circuit breakers shall have thermal-magnetic trip units, with inverse time-current characteristics, unless otherwise noted on the Drawings and/or specified herein.

1. Automatic operation of all circuit breakers shall be obtained by means of thermal-magnetic tripping devices located in each pole providing inverse time delay and instantaneous circuit protection. Instantaneous pick-up settings for each phase shall be adjustable on all frames 250A and above.

2. Circuit breakers shall be ambient compensating in that, as the ambient temperature increases over 40 C, the circuit breaker automatically derates itself to better protect its associated conductor.

3. Circuit breakers 250A and above shall have thermal adjustable magnetic interchangeable trip units.

H. Circuit breaker frames 400 ampere and above shall have microprocessor-based RMS sensing

trip units on 480 volt systems and on 208 volt systems where indicated on the Drawings.

1. Solid State sensing shall measure true RMS current with capability to measure through to the 21st harmonic. Automatic operation of all circuit breakers shall be obtained by means of solid state tripping elements providing inverse time delay and instantaneous and short-time circuit protection. Continuous current rating shall be adjustable from 20% to 100% of trip unit rating. Long-time delay and instantaneous trip ratings shall also be adjustable. The short time pick-up trip shall have adjustable pick-up settings at definite times and with I2t delay.

2. Long time current adjustment shall be possible without the need for a rating plug.

3. Main and feeder circuit breakers shall be provided with integral ground fault protection in 480-volt distribution panels. Ground fault pick-up shall be adjustable from 20% to 70% of the breakers maximum continuous current rating, but in no case, be greater than 1200A. Ground fault time delay shall be adjustable with three (3) I2t delay settings.

4. Solid State circuit breakers shall have built-in test ports for testing the long-time delay, instantaneous, and ground fault functions (if equipped) of the breaker by means of a test set.

5. Provide one (1) test set capable of testing all circuit breakers with a built- in test port.

I. Service entrance panelboards shall utilize a molded case main circuit breaker (MCB) equipped with individual insulated, braced and protected connectors, and single phase protection. The circuit breaker shall use a solid-state trip furnished with a plug-in or panel mounted metering device. This device shall simultaneously display all three phase currents, as well as average current, ground current, and phase unbalance. In addition, it shall display date, time and type (overload, short circuit or ground fault) of trip for the most recent five (5) events.

J. Circuit breaker accessories: Provide shunt trips, bell alarms and auxiliary switches, etc. as may be shown on the Drawings. All accessories shall be UL Listed for field installation.

K. Circuit breakers shall be manufactured by the same manufacturer as the panelboard and factory installed.

L. Where indicated, circuit breakers shall be UL listed for series application.

V. SWITCH AND FUSE UNITS

A. The switch and fuse units shall be quick-make, quick-break type. The units shall be listed by UL for service entrance use where applicable. Each unit shall be enclosed in a

separate steel enclosure. The enclosure shall employ a hinged cover for access to the fuses which shall be interlocked with the operating handle to prevent opening the cover when the

switch is in the ON position. This interlock shall be constructed so that it can be released with a standard electrician's tool for testing fuses without interrupting service. The units shall have padlocking provisions in the OFF position and the operating handle position shall give switch position indication, i.e., horizontal OFF, diagonal ON. Units 30 ampere through 600 ampere shall be rated not less than 100 kAIC with rejection type clips for Class R type fuses. Fuses shall be furnished and installed by this Contractor.

B. Switch and fuse units shall be manufactured by the same manufacturer as the panelboard and factory installed.

VI. MULTIPLE SECTION PANELBOARDS

A. Panelboards with two (2) or more sections shall have sub-feed lugs or thru-feed lugs in all but one (1) section of the panelboard, unless otherwise shown on the Drawings. Lugs shall have same capacity as incoming mains. Cable interconnections shall be field installed.

VII. NAMEPLATES

A. Panelboards shall have nameplates of 1/16-inch thick laminated plastic with 3/16-inch-high white letters on a black background. Nameplates shall identify the panelboard and shall be mounted on the front top of the enclosure.

B. Circuit protective devices shall each have nameplates of 1/16-inch-thick laminated plastic with 1/8-inch-high white letters on a black background. Nameplates shall be mounted in a manner to that above.

VIII. SURGE PROTECTIVE DEVICE (SPD)

A. Provide surge protective devices (SPD) as specified in Section 16418.

Part 3 - Execution

III. EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

IV. INSTALLATION

A. Before installing panelboards, check all of the Drawings for possible conflict of space and adjust the location of the panelboard to prevent such conflict with other items. Panelboard

locations in electrical rooms and other spaces shall closely follow the layouts shown on the Drawings, leaving sufficient space on walls for future installations of panelboards and/or other electrical equipment.

B. Panelboards shall be securely mounted to steel framing channel at locations shown on Drawings. Construction shall be such that additional conduits can be added for future requirements.

C. The cabinets and enclosures shall be mounted in accordance with the NEC. This Contractor shall furnish all materials necessary for mounting the panelboards.

D. Install units plumb, level and rigid without distortion to the distribution panelboard.

E. Panelboard interiors shall be factory assembled with circuit breakers, wire connectors, etc. Circuit breakers shall be sequence numbered to correspond with the panelboard directory.

F. Connect the SPD to the appropriate circuit breaker.

G. Contractor shall install required safety labels.

V. START-UP SERVICE AND PERFORMANCE TEST FOR SERVICE ENTRANCE DISTRIBUTION PANELBOARDS

A. The manufacturer shall provide factory personnel to completely inspect and test the service entrance panelboard(s) for proper installation and operation of all equipment, at the time of system start-up. Testing shall include, but not be limited to, performance testing of the circuit breakers, fused switches (if equipped), SPDs, metering, single phase protection, and ground fault protection systems and equipment.

B. All testing and start-up services shall be in the presence of the Engineer and the Contract Owners Technical Representative (COTR). The tests shall be as stated in the manufacturer's literature. One (1) copy of the tests results shall be submitted to the Engineer and Owner for review.

C. The completed equipment grounding system shall be subjected to a metered test at the service entrance panelboard ground bar to ensure that the ground resistance, without chemical treatment or other artificial means, does not exceed five (5) ohms. One (1) copy of the test results shall be submitted to the Engineer and Owner for review.

VI. FIELD TESTS

A. Check tightness of all accessible mechanical and electrical connections to assure they are torqued to the minimum acceptable manufacturer's recommendations.

B. Check all panelboards for proper grounding, fastening and alignment.

VII. FIELD ADJUSTMENTS

A. This Contractor shall perform field adjustments of the protective devices as required to place

the equipment in final operating condition. Necessary field settings of devices and

adjustments and minor modifications to equipment shall be carried out by this Contractor at no additional cost to the Owner.

B. The settings shall be in accordance with the approved protective device coordination study or as directed by the Engineer.

VIII. TRAINING

A. This Contractor shall provide eight (8) hours of technical service training to the Owner's technical and maintenance staff.

B. The training session shall be conducted by a manufacturer's qualified representative. The training program shall consist of instruction on operation of the assembly, circuit breakers, fused switches (if equipped), metering, and major components within the assembly.

IX. CLEANING

A. Remove debris from panelboards and wipe dust and dirt from all components.

B. Repaint marred and scratched surfaces with touch-up paint to match original finish.

X. EXISTING DISTRIBUTION PANELBOARDS

A. This Contractor shall clean, adjust, and tighten all feeder and branch circuit connections (new and existing) and provide new typewritten directories (as described above) in all existing distribution panelboards that is associated with work on this project. Distribution panelboards not associated with work on this project are not subject to the requirement.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include furnishing and installing distribution panelboards complete for all systems as shown on the Drawings and herein specified.

III. SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.

2. Detail enclosure types and details for types other than NEMA 250, Type 1.

3. Detail bus configuration, current, and voltage ratings.

4. Short-circuit current rating of panelboards and overcurrent protective devices.

5. Include evidence of NRTL listing for series rating of installed devices.

6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

7. Include wiring diagrams for power, signal, and control wiring.

8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

9. The results of coordination and short circuit study shall be submitted along with the submission.

C. Field Quality-Control Reports:

1. Test procedures used.

2. Test results that comply with requirements.

3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

D. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

E. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

IV. QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. All equipment, materials, and their installation shall conform to the requirements of the National Electrical Code (NEC), local code requirements, and these Specifications.

C. All equipment and materials shall be listed by Underwriter's Laboratories, Inc. (UL) for their intended use and shall bear the UL label.

D. Equipment shall be constructed in accordance with National Electrical Manufacturer's Association (NEMA) standards.

E. Submittals are required in accordance with SECTION 16010 of these Specifications. The manufacturer shall furnish, but not be limited to the following:

1. Circuit breaker and/or fusible switch layout with dimensions and nameplate designation.

2. Circuit breaker trip ratings and frame sizes.

3. Fusible switch units’ size, interrupting rating, and fuse rating.

4. Component list.

5. Conduit entry/exit locations.

6. Assembly ratings, including short-circuit rating, voltage, and continuous current

rating.

7. Bus material, including ground bar.

8. Cable terminal sizes.

9. Product data for each type of panelboard.

V. DELIVERY, STORAGE AND HANDLING

A. Deliver material and products in factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations.

B. Each distribution panelboard section shall be delivered in individual shipping splits and individually wrapped for protection and mounted on shipping skids.

C. Store in a clean, dry space. Maintain factory protection and /or provide an additional heavy canvas or heavy plastic cover to protect structure from dirt, water, construction debris, and traffic. Where applicable, provide adequate heating within enclosures to prevent condensation.

D. Handle in accordance with NEMA PB1.1 and manufacturer's written instructions. Handle carefully to avoid damage to panelboard internal components, enclosure and finish.

VI. PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a) Ambient Temperature: Not exceeding 23 deg Fto plus 104 deg F.

b) Altitude: Not exceeding 6600 feet.

3. Service Conditions: NEMA PB 1, usual service conditions, as follows:

a) Ambient temperatures within limits specified.

b) Altitude not exceeding 6600 feet.

Part 2 - Products

I. GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Flush- and surface-mounted cabinets.

1. Rated for environmental conditions at installed location.

a) Indoor Dry and Clean Locations: NEMA 250, Type 1.

b) Outdoor Locations: NEMA 250, Type 3R.

c) Kitchen or Wash-Down Areas: NEMA 250, Type 4X.

d) Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

e) Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive

f) Liquids: NEMA 250, Type 12.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. Finishes:

a) Panels and Trim: galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.

4. Back Boxes: Galvanized steel.

5. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.

B. Incoming Mains Location: Top and/or bottom as determined by the contractor.

C. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.

2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

D. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.

2. Main and Neutral Lugs: Compression type.

3. Ground Lugs and Bus-Configured Terminators: Compression type.

4. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

5. Subfeed (Double) Lugs: Compression type suitable for use with conductor material.

6. Locate at same end of bus as incoming lugs or main device.

E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

II. MANUFACTURERS

A. The distribution switchboard(s) shall be as manufactured by CUTLER-HAMMER, GENERAL ELECTRIC, SIEMENS, or SQUARE D.

III. PANELBOARDS

A. This Contractor shall furnish and install where indicated on the Drawings, deadfront distribution panelboards incorporating switching and branch circuit protective devices of the number, ratings, and type noted herein or as shown on the Drawings. Panelboards shall have NEMA 1 general purpose enclosures and shall be surface mounted. All distribution panelboards shall be rated for the intended voltage and shall be in accordance with UL's "Standard for Panelboards" and "Standard for Cabinets and Boxes" and shall be so labeled. Distribution panelboards shall also comply with NEMA "Standard PB1 For Panelboards" and the NEC. (Circuit breakers) (Switch and fuse units) shall conform to the paragraph, which follows in these Specifications.

B. Ratings:

1. Distribution panelboards rated 240 Vac or less shall have short-circuit ratings as shown on the Drawings or as determined by the Short- Circuit Coordination Study whichever is higher, but not less than 10,000-amperes RMS symmetrical.

2. Distribution panelboards rated 480 Vac shall have short-circuit ratings as shown on the Drawings or as determined by the Short-Circuit Coordination Study whichever is higher, but not less than 14,000- amperes RMS symmetrical.

3. Distribution panelboards used for service entrance shall have short-circuit ratings as shown on the Drawings or as determined by the Short- Circuit Coordination Study whichever is higher, but not less than 65,000 amperes RMS symmetrical at system voltage and be labeled as service entrance equipment in accordance with UL requirements.

4. Distribution panelboards shall have fully rated or series connected short-circuit rated interrupting ratings as indicated on the drawings and shall be labeled with a

UL short-circuit rating. When series connected ratings are applied with integral or remote upstream devices, a label shall be provided. It shall state the conditions of the UL series connected ratings including:

a) Size and type of upstream device.

b) Branch devices that can be used.

c) UL series short-circuit rating.

C. Interiors:

1. All interiors shall be completely factory assembled with switching and protective devices, wire connectors, etc. All conductor connectors, except screw terminals, shall be of the anti-turn solderless type and all shall be suitable for copper conductors of the sizes indicated on the Drawings.

2. Interiors shall be designed so that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors and shall be so designed that circuits may be changed without matching, drilling, or tapping.

D. All distribution panelboards shall be surface mounted on twelve (12) gauge formed steel channel having a cross section dimension at least 1-1/2 inches x 1- 1/2 inches. The channel and fittings shall have a hot dipped galvanized finish to resist rust formation. Channels shall be installed vertically and as detailed on the Drawings.

E. Bus Bars:

1. Bus bars for the mains shall be of copper sized in accordance with UL 67 Standards for temperature rise to limit temperature rise on any current carrying part to a maximum of 65 degrees C above an ambient of 40 degrees C maximum. The bus bars shall be standard density rated for 1000 amperes per square inch copper. Bus bar taps for distribution panelboards with single pole branches shall be arranged for sequence phasing of the branch circuit devices. Busing shall be braced throughout to conform to industry standard practice governing short circuit stresses in panelboards. Phase busing shall be full height without reduction. Cross connectors shall be copper.

2. Phase busing shall be manufactured to accept bolt-on circuit protective devices only.

3. The distribution panelboard shall have fully equipped provision spaces for future protective devices as shown on the Drawings. Remaining space not identified on the Drawings shall be fully bused and pre-drilled for future protective devices that do not have established frame sizes. This is in addition to the scheduled space or spare branches specified or shown on the Drawings.

4. A non-insulated copper ground bus shall be provided for each distribution panelboard.

5. Full size (100% rated) insulated neutral busing shall be included for panelboards shown with a neutral. Neutral busing shall have a suitable lug for each outgoing feeder or branch circuit requiring a neutral connection.

6. Lugs shall be rated for 75 degrees C terminations and shall bolt in place.

F. Backboxes:

1. Backboxes shall be made from unpainted galvanized code gauge steel having no knockouts.

2. Boxes shall have gutter and wiring space sized as required per NEC but not less than four (4) inches on all sides.

3. Backboxes shall also have sufficient space to safely attach clamp-on or split-core current transformers to the feeders for future portable or permanent check metering.

4. Backboxes for multiple (two or more) sections shall be of the same dimensions.

5. Each backbox shall include at least four (4) interior mounting studs.

6. The distribution panelboard identification number shall be on the backbox.

G. Trim:

1. Distribution panelboards having individual switch and fuse units shall have hinged door trims which cover all live parts. Switching device handles shall be accessible. The use of door in a hinged cover type panelboard is prohibited.

2. Doors in distribution panelboard trims shall conform to the following:

a) In making device handles accessible, inboard doors shall not uncover any live parts. Outboard doors shall allow hinged access to the interior panel wiring without removal of the panel door assembly.

b) Doors shall have a semi-flush type cylinder lock and catch. Door hinges shall be concealed. Two (2) keys shall be furnished for each distribution panelboard door and all locks shall be keyed as requested by the Owner to match current standard. The outer door shall be keyed separately. Directory frame and card, having a transparent cover, shall be furnished on the inside of each door.

c) Directory cards shall be neatly typewritten indicating each branch circuit number and assignment. The assignment designation shall include the final room number(s) assigned by the Owner. Do not use the architectural room numbers shown on the Drawings. The directory cards shall also include the source (switchboard, panelboard, etc., with circuit number) feeding the panel.

3. The trims shall be fabricated from code gauge sheet steel.

4. All of the distribution panelboard's steel surfaces, exterior and interior shall be properly cleaned and finished with the manufacturer's standard paint over a rust-inhibiting phosphatized coating. The finish paint shall be of a type to which field applied paint will adhere.

5. Trims shall be mountable by a screwdriver without the need for special tools.

IV. CIRCUIT BREAKERS

A. Electrical circuits shall be protected by molded case circuit breakers as indicated on the Drawings.

B. The circuit breakers shall be operated by a toggle type handle and shall have a quick-make, quick-break over-center switching mechanism that shall be mechanically trip free from the handle so that the contacts cannot be held closed against short circuits and abnormal currents. Tripping due to overload or short circuit shall be clearly indicated by the handle automatically assuming a position midway between the manual "ON" and "OFF" positions. All latch surfaces shall be ground and polished. All poles of a multi-pole breaker shall be so constructed that they open, close, and trip simultaneously.

C. The circuit breakers shall be completely enclosed in a molded case. Non-interchangeable trip breakers shall have their covers sealed; interchangeable trip breakers shall have the trip unit sealed to prevent tampering. Ampere ratings shall be clearly visible. Contacts shall be non-welding silver alloy. Arc extinction shall be accomplished by means of arc chutes consisting of metal grids mounted in an insulating support. Breakers shall be of the bolt-on type; plug-in, plug-on, blow-on, and clamp-on circuit breakers shall not be acceptable.

D. Circuit breakers shall be 80% rated unless indicated on the Drawings to be 100% rated.

E. Circuit breakers shall have a minimum symmetrical interrupting capacity as indicated on the Drawings. The interrupting ratings of the circuit breakers shall be at least equal to, or greater than, the available short circuit at the line terminals and not less than those values shown on the Drawings and specified in this specification section or as determined by the Short-Circuit Coordination Study whichever is higher.

F. Circuit breakers shall be listed with UL, conform to the applicable requirements of the latest issue of NEMA Standards Publication No. AB1.

G. Circuit breakers shall have thermal-magnetic trip units, with inverse time-current characteristics, unless otherwise noted on the Drawings and/or specified herein.

1. Automatic operation of all circuit breakers shall be obtained by means of thermal-magnetic tripping devices located in each pole providing inverse time delay and instantaneous circuit protection. Instantaneous pick-up settings for each phase shall be adjustable on all frames 250A and above.

2. Circuit breakers shall be ambient compensating in that, as the ambient temperature increases over 40 C, the circuit breaker automatically derates itself to better protect its associated conductor.

3. Circuit breakers 250A and above shall have thermal adjustable magnetic interchangeable trip units.

H. Circuit breaker frames 400 ampere and above shall have microprocessor-based RMS sensing trip units on 480 volt systems and on 208 volt systems where indicated on the Drawings.

1. Solid State sensing shall measure true RMS current with capability to measure through to the 21st harmonic. Automatic operation of all circuit breakers shall be obtained by means of solid state tripping elements providing inverse time delay and instantaneous and short-time circuit protection. Continuous current rating shall be adjustable from 20% to 100% of trip unit rating. Long-time delay and instantaneous trip ratings shall also be adjustable. The short time pick-up trip shall have adjustable pick-up settings at definite times and with I2t delay.

2. Long time current adjustment shall be possible without the need for a rating plug.

3. Main and feeder circuit breakers shall be provided with integral ground fault protection in 480-volt distribution panels. Ground fault pick-up shall be adjustable from 20% to 70% of the breakers maximum continuous current rating, but in no case, be greater than 1200A. Ground fault time delay shall be adjustable with three (3) I2t delay settings.

4. Solid State circuit breakers shall have built-in test ports for testing the long-time delay, instantaneous, and ground fault functions (if equipped) of the breaker by means of a test set.

5. Provide one (1) test set capable of testing all circuit breakers with a built- in test port.

I. Service entrance panelboards shall utilize a molded case main circuit breaker (MCB) equipped with individual insulated, braced and protected connectors, and single phase protection. The circuit breaker shall use a solid-state trip furnished with a plug-in or panel mounted metering device. This device shall simultaneously display all three phase currents, as well as average current, ground current, and phase unbalance. In addition, it shall display date, time and type (overload, short circuit or ground fault) of trip for the most recent five (5) events.

J. Circuit breaker accessories: Provide shunt trips, bell alarms and auxiliary switches, etc. as may be shown on the Drawings. All accessories shall be UL Listed for field installation.

K. Circuit breakers shall be manufactured by the same manufacturer as the panelboard and factory installed.

L. Where indicated, circuit breakers shall be UL listed for series application.

V. SWITCH AND FUSE UNITS

A. The switch and fuse units shall be quick-make, quick-break type. The units shall be listed by UL for service entrance use where applicable. Each unit shall be enclosed in a

separate steel enclosure. The enclosure shall employ a hinged cover for access to the fuses which shall be interlocked with the operating handle to prevent opening the cover when the switch is in the ON position. This interlock shall be constructed so that it can be released with a standard electrician's tool for testing fuses without interrupting service. The units shall have padlocking provisions in the OFF position and the operating handle position shall give switch position indication, i.e., horizontal OFF, diagonal ON. Units 30 ampere through 600 ampere shall be rated not less than 100 kAIC with rejection type clips for Class R type fuses. Fuses shall be furnished and installed by this Contractor.

B. Switch and fuse units shall be manufactured by the same manufacturer as the panelboard and factory installed.

VI. MULTIPLE SECTION PANELBOARDS

A. Panelboards with two (2) or more sections shall have sub-feed lugs or thru-feed lugs in all but one (1) section of the panelboard, unless otherwise shown on the Drawings. Lugs shall have same capacity as incoming mains. Cable interconnections shall be field installed.

VII. NAMEPLATES

A. Panelboards shall have nameplates of 1/16-inch thick laminated plastic with 3/16-inch-high white letters on a black background. Nameplates shall identify the panelboard and shall be mounted on the front top of the enclosure.

B. Circuit protective devices shall each have nameplates of 1/16-inch-thick laminated plastic with 1/8-inch-high white letters on a black background. Nameplates shall be mounted in a manner to that above.

VIII. SURGE PROTECTIVE DEVICE (SPD)

A. Provide surge protective devices (SPD) as specified in Section 16418.

Part 3 - Execution

III. EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

IV. INSTALLATION

A. Before installing panelboards, check all of the Drawings for possible conflict of space and adjust the location of the panelboard to prevent such conflict with other items. Panelboard

locations in electrical rooms and other spaces shall closely follow the layouts shown on the Drawings, leaving sufficient space on walls for future installations of panelboards and/or other electrical equipment.

B. Panelboards shall be securely mounted to steel framing channel at locations shown on Drawings. Construction shall be such that additional conduits can be added for future requirements.

C. The cabinets and enclosures shall be mounted in accordance with the NEC. This Contractor shall furnish all materials necessary for mounting the panelboards.

D. Install units plumb, level and rigid without distortion to the distribution panelboard.

E. Panelboard interiors shall be factory assembled with circuit breakers, wire connectors, etc. Circuit breakers shall be sequence numbered to correspond with the panelboard directory.

F. Connect the SPD to the appropriate circuit breaker.

G. Contractor shall install required safety labels.

V. START-UP SERVICE AND PERFORMANCE TEST FOR SERVICE ENTRANCE DISTRIBUTION PANELBOARDS

A. The manufacturer shall provide factory personnel to completely inspect and test the service entrance panelboard(s) for proper installation and operation of all equipment, at the time of system start-up. Testing shall include, but not be limited to, performance testing of the circuit breakers, fused switches (if equipped), SPDs, metering, single phase protection, and ground fault protection systems and equipment.

B. All testing and start-up services shall be in the presence of the Engineer and the Contract Owners Technical Representative (COTR). The tests shall be as stated in the manufacturer's literature. One (1) copy of the tests results shall be submitted to the Engineer and Owner for review.

C. The completed equipment grounding system shall be subjected to a metered test at the service entrance panelboard ground bar to ensure that the ground resistance, without chemical treatment or other artificial means, does not exceed five (5) ohms. One (1) copy of the test results shall be submitted to the Engineer and Owner for review.

VI. FIELD TESTS

A. Check tightness of all accessible mechanical and electrical connections to assure they are torqued to the minimum acceptable manufacturer's recommendations.

B. Check all panelboards for proper grounding, fastening and alignment.

VII. FIELD ADJUSTMENTS

A. This Contractor shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. Necessary field settings of devices and

adjustments and minor modifications to equipment shall be carried out by this Contractor at no additional cost to the Owner.

B. The settings shall be in accordance with the approved protective device coordination study or as directed by the Engineer.

VIII. TRAINING

A. This Contractor shall provide eight (8) hours of technical service training to the Owner's technical and maintenance staff.

B. The training session shall be conducted by a manufacturer's qualified representative. The training program shall consist of instruction on operation of the assembly, circuit breakers, fused switches (if equipped), metering, and major components within the assembly.

IX. CLEANING

A. Remove debris from panelboards and wipe dust and dirt from all components.

B. Repaint marred and scratched surfaces with touch-up paint to match original finish.

X. EXISTING DISTRIBUTION PANELBOARDS

A. This Contractor shall clean, adjust, and tighten all feeder and branch circuit connections (new and existing) and provide new typewritten directories (as described above) in all existing distribution panelboards that is associated with work on this project. Distribution panelboards not associated with work on this project are not subject to the requirement.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include furnishing and installing circuit breaker type branch circuit panelboards complete for all systems as shown on the Drawings and herein specified.

III. SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.

2. Detail enclosure types and details for types other than NEMA 250, Type 1.

3. Detail bus configuration, current, and voltage ratings.

4. Short-circuit current rating of panelboards and overcurrent protective devices.

5. Include evidence of NRTL listing for series rating of installed devices.

6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

7. Include wiring diagrams for power, signal, and control wiring.

8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

9. The results of coordination and short circuit study shall be submitted along with the submission.

C. Field Quality-Control Reports:

1. Test procedures used.

2. Test results that comply with requirements.

3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

D. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

E. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

IV. QUALITY ASSURANCE

A. General Requirements

1. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

2. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

3. All equipment, materials, and their installation shall conform to the requirements of the National Electrical Code (NEC), local code requirements, and these Specifications.

4. All equipment and materials shall be listed by Underwriter's Laboratories, Inc. (UL) for their intended use and shall bear the UL label.

5. Equipment shall be constructed in accordance with National Electrical Manufacturer's Association (NEMA) PB1 standards.

B. Submittals are required in accordance with SECTION 16010 of these Specifications. The manufacturer shall furnish, but not be limited to the following:

1. Circuit breaker layout with dimensions and nameplate designation.

2. Circuit breaker trip ratings and frame sizes.

3. Component list.

4. Conduit entry/exit locations.

5. Assembly ratings, including short-circuit rating, voltage, and continuous current rating.

6. Bus material, including ground bar.

7. Cable terminal sizes.

8. Product data for each type of panelboard.

V. DELIVERY, STORAGE AND HANDLING

A. Deliver material and products in factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations.

B. Each panelboard section shall be delivered in individual shipping cases and individually wrapped for protection.

C. Store in a clean, dry space. Maintain factory protection and /or provide an additional heavy canvas or heavy plastic cover to protect panelboards from dirt, water, construction debris, and traffic. Where applicable, provide adequate heating within enclosures to prevent condensation.

D. Handle in accordance with NEMA PB1.1 and manufacturer's written instructions. Handle carefully to avoid damage to panelboards internal components, enclosure and finish.

VI. PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a) Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.

b) Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.

2. Altitude not exceeding 6600 feet.

VII. COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

Part 2 - Products

I. MANUFACTURERS

A. The branch circuit panelboards shall be as manufactured by CUTLER-HAMMER, GENERAL ELECTRIC, SIEMENS, or SQUARE D.

II. PANELBOARDS

A. This Contractor shall furnish and install where indicated on the Drawings, deadfront branch circuit panelboards incorporating switching and branch circuit protective devices of the number, ratings, and type noted herein or as shown on the Drawings. Branch circuit panelboards shall have NEMA 1 general purpose enclosures and shall be surface or flush mounted as noted. All branch circuit panelboards shall be rated for the intended voltage and shall be in accordance with UL's "Standard for Panelboards" and "Standard for Cabinets and Boxes" and shall be so labeled. Branch circuit panelboards shall also comply with NEMA "Standard PB1 for Panelboards" and the NEC.

B. Ratings: [ENGINEER, EDIT OUT SHORT-CKT STUDY IF NOT IN PROJECT]

1. Panelboards rated 240 Vac or less shall have short-circuit ratings as shown on the drawings or as determined by the Short-Circuit Coordination Study whichever is higher, but not less than 10,000- amperes RMS symmetrical.

2. Panelboards rated 480 Vac shall have short-circuit ratings as shown on the drawings or as determined by the Short-Circuit Coordination Study whichever is higher, but not less than 14,000-amperes RMS symmetrical.

3. If required, panelboards shall have a fully rated or series connected short-circuit rated interrupting ratings as indicated on the drawings and shall be labeled with a UL short-circuit rating. When series connected, ratings are applied with integral or remote upstream devices, a label shall be provided. It shall state the conditions of the UL series connected ratings including:

a) Size and type of upstream device.

b) Branch devices that can be used.

c) UL series short-circuit rating.

C. Enclosures: Flush- and surface-mounted cabinets.

1. Rated for environmental conditions at installed location.

a) Indoor Dry and Clean Locations: NEMA 250, Type 1.

b) Outdoor Locations: NEMA 250, Type 3R.

c) Kitchen or Wash-Down Areas: NEMA 250, Type 4X.

d) Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

e) Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive

III. Liquids: NEMA 250, Type 12.

A. Interiors:

1. All interiors shall be completely factory assembled with switching and protective devices, wire connectors, etc. All conductor connectors, except screw terminals, shall be of the anti-turn solderless type and all shall be suitable for copper conductors of the sizes indicated on the Drawings.

2. Interiors shall be designed so that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors and shall be so designed that circuits may be changed without matching, drilling, or tapping.

B. Branch circuits shall be arranged using double row construction except where a narrow column width panelboard is required or noted on the Drawings. Branch circuits shall be numbered by the manufacturer.

C. Furnish and install three (3), 3/4 inch and two (2), one inch empty conduits up through the wall and turned out above the ceiling; and three (3), 3/4 inch and two (2), one inch empty conduits down into the ceiling space below the floor for all flush mounted branch circuits panelboards. Where floor slab is on grade, provide only empty conduits to the ceiling.

D. All surface mounted branch circuit panelboards shall be mounted on twelve (12) gauge formed steel channel having a cross section dimension at least 1-1/2 inches x 1-1/2 inches on walls. The channel and fittings shall have a hot dipped galvanized finish to resist rust formation. Channels shall be installed vertically and as detailed on the Drawings.

E. Bus Bars:

1. Bus bars for the mains shall be of copper, Hard-drawn copper, 98 percent

conductivity sized in accordance with UL 67 Standards for temperature rise to limit temperature rise on any current carrying part to a maximum of 65 degrees C above an ambient of 40 degrees C maximum. The bus bars shall be standard density rated for 1000 amperes per square inch copper. Bus bar taps for branch circuit panelboards with single pole branches shall be arranged for sequence phasing of the branch circuit devices. Busing shall be braced throughout to conform to industry standard practice governing short circuit stresses in panelboards. Phase busing shall be full height without reduction. Cross connectors shall be copper. A non-insulated copper ground bus shall be provided for each panelboard.

2. Phase busing shall be manufactured to accept bolt-on circuit breakers only.

3. Spaces for the addition of future switching and protective devices in branch circuit panelboards shall be bussed for the maximum number of devices possible complete with pre-drilled mounting holes and knockouts in the front cover.

4. A non-insulated copper ground bus shall be provided for each branch circuit panelboard.

    a) Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

5. Full size (100% rated) insulated neutral busing shall be included for panelboards shown with a neutral. Neutral busing shall have a suitable lug for each outgoing feeder or branch circuit requiring a neutral connection.

6. Lugs shall be rated for 75 degrees C terminations and shall bolt in place.

F. Backboxes:

1. Backboxes shall be made from unpainted galvanized code gauge steel having no knockouts.

2. Boxes shall have gutter and wiring space sized as required per NEC but not less than four (4) inches on all sides. Where feeder cables supplying the mains of a panelboard are carried through the box to supply other electrical equipment, the box shall be so sized as to include this wiring space. This wiring space shall be in addition to the minimum gutter space specified above and the limiting width may be increased accordingly.

3. Backboxes shall also have sufficient space to safely attach clamp-on or split-core current transformers to the feeders for future portable or permanent check metering.

4. Backboxes for multiple (two or more) sections shall be of the same dimensions.

5. Each backbox shall include at least four (4) interior mounting studs.

6. The branch circuit panelboard identification number shall be on the backbox.

7. Branch circuit panelboard backboxes shall be of one (1) piece construction.

G. Trim:

1. Hinged doors shall be the door-in-door type covering all switching device handles and all live parts and shall be included in all branch circuit panelboard trims. The use of door in a hinged cover type panelboard is prohibited.

2. Doors in branch circuit panelboard trims shall conform to the following:

a) In making device handles accessible, inboard doors shall not uncover any live parts. Outboard doors shall allow hinged access to the interior panel wiring without removal of the panel door assembly.

b) Doors shall have a semi-flush type cylinder lock and catch. Door hinges shall be concealed. Two (2) keys shall be furnished for each panelboard door and all locks shall be keyed as requested by the Owner to match current standard. The outer door shall be keyed separately. Directory frame and card, having a transparent cover, shall be furnished on the inside of each door.

c) Directory cards shall be neatly typewritten indicating each branch circuit number and assignment. The assignment designation shall include the final room number(s) assigned by the Owner. Do not use the architectural room numbers shown on the Drawings. The director cards shall also include the source (switchboard, panelboard, etc. with circuit number) feeding the panel.

3. The trims shall be fabricated from code gauge sheet steel.

4. All of the panelboard's steel surfaces, exterior and interior shall be properly cleaned and finished with the manufacturer's standard paint over a rust-inhibiting phosphatized coating. The finish paint shall be of a type to which field applied paint will adhere.

5. Trims for flush mounted branch circuit panelboards shall overlap the box by at least 3/4 inches on all sides. Surface trims shall be mountable by a screwdriver without the need for special tools.

H. Conduit skirts shall be provided on surface mounted branch circuit panelboards, where shown on the drawings. Skirts shall be the same width and depth as the panelboard backbox. Screw on skirt covers shall be the same code gauge sheet steel as the panelboard trim and painted with the same finish and color as the panelboard. Skirts shall be from the top of the panelboard to the underside of the finished ceiling and/or

from the bottom of the panelboard to the finished floor concealing all conduits.

IV. CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

3. Siemens Energy & Automation, Inc.

4. Square D; a brand of Schneider Electric.

B. Electrical circuits shall be protected by molded case circuit breakers as indicated on the Drawings.
1. Comply with UL 489, with full interrupting capacity to meet available fault currents.

C. The circuit breakers shall be operated by a toggle type handle and shall have a quick-make, quick-break over-center switching mechanism that shall be mechanically trip free from the handle so that the contacts cannot be held closed against short circuits and abnormal currents. Tripping due to overload or short circuit shall be clearly indicated by the handle automatically assuming a position midway between the manual "ON" and "OFF" positions. All latch surfaces shall be ground and polished. All poles of a multi-pole breaker shall be so constructed that they open, close, and trip simultaneously.

D. The circuit breakers shall be completely enclosed in a molded case. Non-interchangeable trip breakers shall have their covers sealed; interchangeable trip breakers shall have the trip unit sealed to prevent tampering. Ampere ratings shall be clearly visible. Contacts shall be non-welding silver alloy. Arc extinction shall be accomplished by means of arc chutes consisting of metal grids mounted in an insulating support. Breakers shall be of the bolt-on type; plug-in, plug-on, blow-on, and clamp-on circuit breakers shall not be acceptable.

E. Circuit breakers shall be 80% rated unless indicated on the Drawings to be 100% rated.

F. Circuit breakers shall have a minimum symmetrical interrupting capacity as indicated on the Drawings. The interrupting ratings of the circuit breakers shall be at least equal to, or greater than, the available short circuit at the line terminals and not less than those values shown on the Drawings and specified in this specification section or as determined by the Short-Circuit Coordination Study whichever is higher.

V. Short Circuit Study (Use as Needed)

A. Circuit breakers shall be listed with UL, conform to the applicable requirements of the

latest issue of NEMA Standards Publication No. AB1.

B. Circuit breakers shall have thermal-magnetic trip units, with inverse time-current characteristics, unless otherwise noted on the Drawings and/or specified herein.

1. Automatic operation of all circuit breakers shall be obtained by means of thermal-magnetic tripping devices located in each pole providing inverse time delay and instantaneous circuit protection. Instantaneous pick-up settings for each phase shall be adjustable on all frames 250A and above.

2. Circuit breakers shall be ambient compensating in that, as the ambient temperature increases over 40 C, the circuit breaker automatically derates itself to better protect its associated conductor.

3. Circuit breakers 250A and above shall have thermal magnetic interchangeable trip units.

4. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).

5. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

a) Standard frame sizes, trip ratings, and number of poles.

b) Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.

c) Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.

d) Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

e) Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.

f) Multipole units enclosed in a single housing or factory assembled to operate as a single unit.

g) Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.

h) Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

C. Circuit breaker frames 400 amperes and above shall have microprocessor-based RMS

sensing trip units on 480 volt systems and on 208 volt systems where indicated on the Drawings.

1. Solid State sensing shall measure true RMS current with capability to measure through to the 21st harmonic. Automatic operation of all circuit breakers shall be obtained by means of solid state tripping elements providing inverse time delay and instantaneous and short-time circuit protection. Continuous current rating shall be adjustable from 20% to 100% of trip unit rating. Long-time delay and instantaneous trip ratings shall also be adjustable. The short time pick-up trip shall have adjustable pick-up settings at definite times and with I2t delay.

2. Long time current adjustment shall be possible without the need for a rating plug.

3. Main and feeder circuit breakers shall be provided with integral ground fault protection in 480 volt panels. Ground fault pick-up shall be adjustable from 20% to 70% of the breakers maximum continuous current rating, but in no case, be greater than 1200A. Ground fault time delay shall be adjustable with three (3) I2t delay settings.

4. Solid State circuit breakers shall have built-in test ports for testing the long-time delay, instantaneous, and ground fault functions (if equipped) of the breaker by means of a test set.

5. Provide one test set capable of testing all circuit breakers with a built-in test port, unless previously provided under another section of these specifications.

D. Circuit breaker accessories: Provide shunt trips, bell alarms and auxiliary switches, etc. as may be shown on the drawings. All accessories shall be UL Listed for field installation.

E. Circuit breakers shall be manufactured by the same manufacturer as the panelboard and factory installed.

F. Where indicated, circuit breakers shall be UL listed for series application. (ENGINEER TO EDIT OUT THIS PARAGRAPH IF NOT USING SERIES CONNECTED BREAKERS.)

VI. MULTIPLE SECTION PANELBOARDS

A. Panelboards with two (2) or more panelboard sections, sub-feed lugs or thru- feed lugs shall be used in all but one (1) section of each panelboard, unless otherwise shown on the Drawings. Lugs shall have same capacity as incoming mains. Cable interconnections shall be field installed.

VII. NAMEPLATES

A. Branch circuit panelboards shall have nameplates of 1/16-inch-thick laminated plastic

with 3/16-inch-high white letters on a black background. Nameplates shall identify the branch circuit panelboard and shall be mounted on the front top of the enclosure.

VIII. SURGE PROTECTIVE DEVICE (SPD)

A. Provide surge protective devices (SPD) as specified in Section 16418.

Part 3 - Execution

I. INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Before installing branch circuit panelboards, this Contractor shall check all of the Drawings for possible conflict of space and adjust the location of the branch circuit panelboard to prevent such conflict with other items. Panelboard locations in electrical rooms and other spaces shall closely follow the layouts shown on the Drawings, leaving sufficient space on walls for future installations of panelboards and/or other electrical equipment.

C. Surface mounted branch circuit panelboards shall be securely mounted to steel framing channel at locations shown on Drawings. Construction shall be such that additional conduits can be added for future requirements. Retain a minimum of 20% space/spare capacity.

D. Mount top of trim 90 inches above finished floor unless otherwise indicated in order to keep the highest breaker at 79” above finished floor.

E. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

F. The cabinets and enclosures shall be mounted in accordance with the NEC. This Contractor shall furnish all materials necessary for mounting the branch circuit panelboards.

G. Install units plumb, level and rigid without distortion to the branch circuit panelboard.

H. Branch circuit panelboard interiors shall be factory assembled with circuit breakers, wire connectors, etc. Circuit breakers shall be sequence numbered to correspond with the panelboard directory.

I. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

J. Comply with NECA 1.

K. Connect the SPD to the appropriate circuit breaker.

L. Contractor shall install required safety labels.

M. The mounting of junction boxes, wire troughs, and auxiliary gutters to the top, bottom or sides of a branch circuit panelboard is prohibited unless approved by the PGCPS technical inspection staff on a case by case basis.

II. FIELD TESTS

A. Check tightness of all accessible mechanical and electrical connections to assure they are torqued to the minimum acceptable manufacturer's recommendations.

B. Check all panelboards for proper grounding, fastening and alignment.

III. FIELD ADJUSTMENTS

A. This Contractor shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. Necessary field settings of devices and adjustments and minor modifications to equipment shall be carried out by this Contractor at no additional cost to the Owner.

B. The settings shall be in accordance with the approved protective device coordination study or as directed by the Engineer.

IV. CLEANING

A. Remove debris from panelboards and wipe dust and dirt from all components.

B. Repaint marred and scratched surfaces with touch-up paint to match original finish.

V. EXISTING BRANCH CIRCUIT PANELBOARDS

A. This Contractor shall clean, adjust, and tighten all feeder and branch circuit connections (new and existing) and provide new dated typewritten directories (as described above) in all existing branch circuit panelboards that are associated with work on this project. Panelboard's not associated with work on this project are not subject to this requirement.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall consist of furnishing and installing (a) motor control center(s) as shown on the Drawings and herein specified.

III. SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for motor control centers, enclosures, units, overcurrent protective devices, and other installed components and accessories.

1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.

2. Arc-Resistant Motor Control Centers: Indicate IEEE C37.20.7 accessibility type, and maximum fault current and arc duration.

B. Shop Drawings: Indicate dimensions, voltage, bus ampacities, unit arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. Include dimensioned plan and elevation views of motor control centers and adjacent equipment with all required clearances indicated.

2. Include wiring diagrams showing all factory and field connections.

3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.

4. Include documentation of listed series ratings upon request.

5. Include documentation demonstrating selective coordination upon request.

6. Arc-Resistant Motor Control Centers: Include proposed plenum arrangement, where applicable.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Field Quality Control Test Reports.

E. Project Record Documents: Record actual installed locations of motor control centers and final equipment settings.

1. Include nameplate data of actual installed motors and associated overload relay selections and settings.

2. Motor Circuit Protectors: Include magnetic instantaneous trip settings.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Division 1 - Product Requirements, for additional provisions.

2. Enclosure Keys: Two of each different key

3. Indicating Lights: Two of each different type. Electronic Trip Circuit Breakers: Provide one portable test set.

IV. QUALITY ASSURANCE

A. All equipment, materials, and installation shall conform to the requirements of the National Electrical Code (NEC), state and local codes, and these Specifications.

B. All equipment and material shall be listed by Underwriter's Laboratories, Inc. (UL) for their intended use and shall bear the UL label.

C. Equipment shall be constructed in accordance with National Electrical Manufacturer's Association (NEMA) standards.

D. Submittals are required in accordance with Division 1 of these Specifications.

V. DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store motor control centers in accordance with manufacturer's instructions, NECA 402, and NEMA ICS 2.3.

B. Store in a clean, dry space having a uniform temperature to prevent condensation. Where necessary, provide temporary enclosure space heaters or temporary power for permanent factory-installed space heaters.

C. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

D. Handle carefully to avoid damage to internal components, enclosure, and finish.

Part 2 - Products

I. MANUFACTURER

A. Source Limitations: Furnish motor control centers and associated components produced

by a single manufacturer and obtained from a single supplier.

B. The motor control center shall be as manufactured by CUTLER-HAMMER, GENERAL ELECTRIC, SIEMENS, or SQUARE D.

II. MATERIALS AND COMPONENTS

A. The motor control center shall be designed in accordance with NEMA Standards and shall be NEMA Class IS, Type B-T and shall consist of independent vertical sections, free standing on four (4) inch channel iron sills with sections bolted together to make up the center.

B. The motor control center supply voltage shall be as indicated and/or noted on the Drawings. Adequate ventilation shall be furnished to prevent abnormal starter tripping by the normally rated heater units in each control compartment. The size shall be a maximum of ninety (90) inches overall in height, including the mounting sill. The width of each section shall be a maximum twenty (20) inch structure and shall be arranged for front mounting only and shall not exceed twenty-two (22) inches in depth. Each section shall be dead front and rear access shall not be required for connections. Removable rear plates shall be employed on the rear of the structure. Pan type doors shall be used for all units and future spaces. Doors shall be hinged to the structure with a concealed hinge, and fastened with pressure type fasteners. All door openings shall be gasketed. The top of each section shall have a removable plate for access to the horizontal feeder bus and for conduit entry. Manufacturer's standard gauge steel shall be used throughout the structure including all doors and plates. All painted steelwork shall be treated with a primer coat and finish coat, or bonderized and finished with the manufacturer's standard baked enamel.

C. Each section shall contain three (3) feeder tin-plated copper bus bars, which shall run continuously through the center from section to section. Provisions shall be made for easy addition and connection to adjacent sections. The horizontal bus shall be sized as noted on the Drawings, but with a minimum rating of 600 amps, and 1/4 inch x 2-inch bus bars. The horizontal bus shall be extended with this same capacity the entire length of the center. The horizontal bus shall be braced to withstand minimum 65,000 amps RMS asymmetrical fault current, or as indicated on the Drawings. Each motor control center section shall be furnished with an uninsulated non-current carrying 1/4 inch x 2-inch tin-plated copper bus bar which shall be suitably bolted to related bus bar supports in adjacent sections in order to furnish a separate ground bus. The bus supports shall be formed of high dielectric strength, low moisture-absorbing, high-impact material with ample creepage distance between bus bars. Each section shall contain three (3) vertical tin-plated bus bars running the full working height of the section and connected to the horizontal feeder bus bars. The vertical bus bars shall have a minimum rating of 300 amps and be braced for withstanding 65,000 amps RMS asymmetrical fault current, or as indicated on the Drawings.

D. Each section shall have a top horizontal wiring trough in front of the main horizontal bus and the same wiring trough in back of the horizontal bus in minimum twenty (20) inch depth structures. This wiring trough shall be protected from the horizontal bus bars by means of a steel barrier plate. The wiring trough shall be equipped with cable supports and the structure shall have a cutout in the end for continuous cable runs through the

motor control center. A vertical wiring through shall run the full working height of each section and shall be equipped with cable tie clamps. This vertical wiring trough shall be designed to allow installation of wiring to units with the unit doors open, but with units in place. A minimum of three (3) inches of access between the unit terminal blocks and the side of the structure shall be furnished for the wiring trough.

E. Motor starter units shall be of the combination switch and fuse type and/or instantaneous magnetic trip only circuit breakers for motor short circuit protection of the rating and type as indicated on the Drawings. Units shall be connected to the vertical bus bar in each section with a stab-on power plug connector on the back of the unit. These stab-on connectors shall be free floating silver plated clips, self-aligning and backed up with a steel spring pressure clip. Each unit shall have an engraved identifying nameplate (black letters on a white background) showing the circuit it controls. The unit shall be capable of being withdrawn from the structure with a minimum of difficulty and shall have provisions for being locked in a test position. Control circuit connections shall be made through a pull-apart terminal block. The male portion of the terminal block shall be removable. All spring clips and stabs shall be recessed into the molding for safety and to protect them from being damaged. The male portions of the terminal block shall be entirely separable from the structure and unit, so that it can be wired outside of the structure. The rating of the pull-apart block shall be not less than 30 amps. Motor power lead connections above 30 amps shall be wired into fixed terminal blocks on the unit panels.

III.

A. Indicating lights, pushbuttons, and selector switches shall be furnished as indicated on the Drawings and shall be mounted with the motor starter units on a hinged plate in the unit itself and withdrawn from the unit without the removal of any wiring or elements. Pilot lights shall be the press-to-test type and it shall be possible to test the lamp regardless of whether the overload relay is tripped or in the reset position. Unit support brackets shall be furnished in the structure to properly align the units. Cam latch fasteners shall be employed on each unit to latch the unit in either an engaged or test position in the structure as follows: in the engaged position the stabs shall be connected to the vertical power bus; or in the test position with units withdrawn from the vertical power bus but still supported by the structure. In the test position, the pull-apart terminal block shall be still capable of being engaged for electrical testing purposes. In either engaged or test positions, the cam latching mechanism on the unit shall be capable of being padlocked to prevent unauthorized movement of the unit. Units shall have complete steel top and bottom plates to provide maximum isolation between units. Handles shall be provided on units for ease of withdrawal. Units shall be of modular dimensions so that it is possible to readily interchange units of the same size without modifications to the structure. Operating handles shall be mounted on the unit door. They shall have defeatable door interlocks that prevent the doors from opening with the switch in the ON position. The operating handle shall be arranged for padlocking in the OFF position with up to three (3) padlocks.

IV. MOTOR STARTERS

A. Combination starter units shall be full-voltage non-reversing, unless otherwise shown on the drawings. Starters shall be sized in accordance with NEMA Standards for Industrial Control, except that no smaller than NEMA Size 0 starters shall be employed in any unit. Combination starter units shall utilize motor circuit protector (MCP) circuit breakers

or switch and fuse units as shown on the Drawings and shall conform to the following:

1. Motor Circuit Protectors Description: Instantaneous-trip circuit breakers furnished with magnetic instantaneous tripping elements for short circuit protection, but not with thermal inverse time tripping elements for overload protection; UL 489 recognized only for use as part of a listed combination motor controller with overload protection; ratings, configurations, and features as indicated on the drawings.
2. Each combination unit utilizing motor circuit protectors shall be rated 65,000 AIC symmetrical at rated voltage. The MCP shall provide adjustable magnetic protection, which has an adjustment range that can be set to 1700% motor nameplate full load current to comply with NEC requirements. The magnetic trips shall be adjustable from the front of the MCP. All MCP combination units shall have a “tripped” position on the unit disconnect and a push-to-test button on the MCP. The MCP shall include transient override feature for motor inrush current. The MCP shall be used to provide short circuit coordination to 65,000 amperes.
3. Switch and Fuse Units: Fusible switches shall be quick-make, quick- break and shall accept class R fuses and the combination shall safely interrupt 100,000 amperes. Fusible combination starters shall provide short circuit coordination to 100,000 amperes.

V. OVERCURRENT DEVICES

A. Individual feeder circuit breakers shall be thermal magnetic type and shall have a minimum interrupting capacity of 65,000 AIC at rated voltage or as scheduled on the Drawings.

B. Individual feeder fusible switches shall be quick-make, quick-break gang- operated type using Class “R” fuse clips. The fused switch shall be rated 100,000 AIC at rated voltage. The fusible switch shall have a defeatable door interlocked to prevent the door from opening with the switch in the ON position. The operating handle shall be arranged for padlocking in the OFF position with up to three (3) padlocks.

C. Overcurrent devices shall be dual mounted where possible.

VI. PHASE LOSS PROTECTION

A. The motor control center shall be provided with a full height and width blank section having hinged latching doors for the installation of phase loss monitoring relays. Section shall be provided with all necessary mounting hardware, rails, etc. to accept the phase loss monitoring relays. The phase loss monitoring relays shall be furnished and installed by the Division 15 Contractor. This Contractor shall coordinate the installation and wiring of the phase loss monitor relays.

VII. BRANCH CIRCUIT PANELBOARDS

A. Where shown on the Drawings, provide a branch circuit panelboard within the motor

control center. Panelboard shall be fully rated or UL series-connected rated for 65,000 AIC. Refer to Specification Section 16435 Branch Circuit Panelboards.

VIII. DRY-TYPE TRANSFORMERS

A. Where shown on the Drawings, provide a three-phase dry-type transformer within the motor control center. The transformer shall be located in the bottom unit space of the section due to weight. Transformer rating shall be as shown on the Drawings, but not larger than 45 kVA. The transformers shall include primary and secondary circuit breakers housed behind a single door. The transformer and circuit breaker assembly shall be rated for 65,000 AIC. Refer to Specification Section 16450 Dry-Type Transformers.

IX. 2.8 SURGE PROTECTIVE DEVICE (SPD)

A. Provide surge protective devices (SPD) as specified in Section 16418.

X. NAMEPLATES

A. Motor Control Centers shall have nameplates of 1/16-inch-thick laminated plastic with 3/16-inch-high white letters on a black background. Nameplates shall identify the motor control center and shall be mounted on the front top of the enclosure. Nameplates shall be screw fastened. Adhesive backed, embossed lettering tape is not acceptable.

B. Each device installed in the motor control center shall be identified with a suitable nameplate with 1/8-inch-high white letters on a black background. Nameplates shall be mounted in a manner to that above.

XI. MOTOR CONTROL ACCESSORIES

A. Auxiliary Contacts:

1. Comply with NEMA ICS 5; heavy-duty type.

2. Nominal Size: 30 mm

3. Pushbuttons: Unless otherwise indicated, provide momentary, non-illuminated type with flush button operator; normally open or normally closed as indicated or as required.

4. Selector Switches: Unless otherwise indicated, provide maintained, non-illuminated type with knob operator; number of switch positions as indicated or as required.

5. Indicating Lights: Push-to-test type unless otherwise indicated.

6. Provide LED lamp source for indicating lights and illuminated devices.

B. Control and Timing Relays:

1. Comply with NEMA ICS 5

2. Provide number and type of relays indicated or required to perform necessary functions.

3. Timing Relays: Electronic or pneumatic as indicated.

4. Adjustable Timing Range: As indicated on drawings.

5. Multi-Speed Motor Starters: Employ accelerating relays, decelerating relays, and compelling relays where indicated.

6. Accelerating Relays: Starts motor at low speed and then accelerates automatically through definite time intervals for each successive speed until selected speed is attained.

7. Decelerating Relays: Allows motor to decelerate automatically through definite time intervals for each successive speed until selected speed is attained.

XII. C. Control Power Transformers:

1. Size to accommodate burden of contactor coil(s) and all connected auxiliary devices, plus[1] VA spare capacity as provided by engineer.

2. Include primary and secondary fuses.

B. Control Terminal Blocks: Include 25 percent spare terminals.

Part 3 - Execution

I. INSTALLATION

A. The motor control center shall be installed in accordance with the manufacturer's recommendations and as shown on the Drawings.

B. The Contractor shall furnish and install a four (4) inch high by four (4) inch greater all sides (except rear when the motor control center is mounted against a wall) concrete housekeeping pad for the motor control center.

C. Motor control center wiring for factory mounted devices shall be installed complete at the factory and adequately bundled and protected. All conductors across hinges, and all conductors for interconnections between shipping units, shall be flexible.

D. Rig the motor control center assembly into final location and install on level surface.

E. This Contractor shall provide clearance around equipment in accordance with latest National Electrical Code.

II. FIELD QUALITY CONTROL

A. Check all removable cells and starter units for easy removal and insertion.

B. Perform insulation tests on each phase and verify low-resistance ground connections on ground bus.

C. Connect all wiring and verify basic operation of each starter from the control power source.

D. Torque all bolted connections made in the field and verify all factory bolted connections.

E. Overload relay heater ratings must be properly sized and coordinated for each motor starter unit.

END OF SECTION

Feeder Busway Section 262500

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work under this Section shall include furnishing and installing prefabricated feeder busway distribution system(s) including all necessary fittings, hangers, and accessories as shown on the Drawings and herein specified.

III. ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the arrangement of busway with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others. Coordinate the work with other trades to avoid installation of obstructions within busway required clearances.

2. Coordinate arrangement of busway with the dimensions and clearance requirements of the actual equipment to be installed.

3. Coordinate the work with placement of supports, anchors, etc. required for mounting.

4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.

5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

6. Preinstallation Meeting: Convene one week prior to performing field measurements for busway fabrication drawings; require attendance of all affected installers. Review proposed routing, sequence of installation, and protection requirements for installed busway.

7. Sequencing: Perform field measurements prior to busway fabrication.

IV. SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for

busway system components and accessories. Include dimensions, weight, materials, fabrication details, finishes, and service condition requirements. Indicate voltage and current ratings, short circuit current ratings, configurations, and installed features and accessories.

1. Include busway resistance, reactance, and impedance data and voltage drop ratings.

2. Include characteristic trip curves for each type and rating of circuit breaker plug-in device upon request.

3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.

4. Include documentation of listed series ratings upon request.

B. Field Quality Control Test Reports.

1. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

2. Project Record Documents: Record actual routing of busway. Include actual installed locations of plug-in units.

3. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

a) Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

b) See Division 1 - Product Requirements, for additional provisions.

c) Hook Stick(s) for Plug-In Units With Hook Stick Operable Handles: One, with length as required for suitable operation of plug-in unit handle from floor or working platform

V. QUALITY ASSURANCE

A. All equipment, materials, and their installation shall conform to the requirements of the National Electrical Code (NEC), local code requirements, and these Specifications.

B. All equipment and materials shall be listed by Underwriter's Laboratories, Inc. (UL) for their intended use and shall bear the UL label.

C. Equipment shall be constructed in accordance with National Electrical Manufacturer's Association (NEMA) standards.

D. All of the busway components shall be of the same manufacturer and be of the same manufacturer as the switchboard, see SECTION 262413.

E. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

F. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience with busway systems of similar size, type, and complexity.

G. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

H. Submittals are required in accordance with Division 1 of these Specifications. Submittals shall include, but not be limited to the following:

1. Product data to include all dimensions, weights, electrical ratings, wiring diagrams, required clearances, fittings, hangers and accessories.

2. A dimensioned isometric drawing, prepared by the manufacturer, for each feeder busway system showing the layout for and identification of all required components, including hanger spacing.

3. Cable terminal sizes and ratings.

VI. DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store busway in accordance with manufacturer's instructions, NECA 408, and NEMA BU1.1.

B. Store products indoors in a clean, dry space having a uniform temperature to prevent condensation. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle products carefully to avoid damage to internal components, enclosure, and finish.

VII. FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

Part 2 - Products

I. MATERIALS AND COMPONENTS

A. This Contractor shall furnish and install prefabricated feeder busway distribution system(s) as shown on the Drawings and as specified herein including all necessary fittings, hangers, and accessories. The feeder busway distribution system(s) shall consist of standard ten (10) foot sections with special sections and fittings provided to suit the installation. Horizontal runs shall be suitable for hanging on ten (10) foot maximum support centers. On vertical runs, one (1) adjustable vertical hanger per floor shall be furnished and installed. The feeder busway shall meet the latest applicable standards of NEMA, ANSI, and UL 857.

B. Busway shall be 277/480 volt, three phase, four wire with 100% neutral and 50% capacity integral (housing) and/or internal ground bus as manufactured by CUTLER-HAMMER, GENERAL ELECTRIC, SIEMENS, or SQUARE D. Feeder busway

ampere rating shall be as noted on the Drawings.

C. The busway shall be of the low impedance type, totally enclosed and non- ventilated for protection against mechanical damage and dust accumulation. The housing shall meet NEC requirements and shall be a 2-piece design fabricated from extruded aluminum. The 2-piece housing shall be bolted together along with bottom flange using grade 5, 1⁄4 x 20 zinc-plated fasteners on 3-inch centers for maximum mechanical strength. The busway enclosure finish shall be ANSI 61 gray baked epoxy powder paint applied by an electrostatic process.

D. Each busway section shall be furnished complete with joint hardware and covers. The joints shall be a single-bolt, non-rotating, removable bridge design. All bridge joints shall be furnished with torque-indicating double head joint bolts and Belleville washers. The bridge joint shall ensure proper installation without the use of a torque wrench. Each joint shall allow for a minimum length adjustment of +\- 0.5 inches. De-energization of busway shall not be required for safe testing of joint tightness. Access to only one side of the busway shall be required for tightening or inspection of the joint. Joint covers shall be provided with captive hardware. It shall be possible to remove any joint connection assembly to allow electrical isolation or physical removal of a busway length without disturbing adjacent busway lengths.

E. Bus bars shall be fabricated from high strength 98% conductivity copper and suitably plated at all electrical contact surfaces. Bus bars shall be insulated over their entire length, except at joints and contact surfaces, with an UL listed insulating material consisting of epoxy applied by fluidized bed process or electrostatically applied Class B (130-degree C. certified) epoxy insulation. Busway shall be of sandwich construction meaning no air gap

shall exist between bus bars except at the joints. Bus bars shall be tin plated at all contact surfaces.

F. Busway[1] shall be braced to withstand engineer recommended maximum RMS symmetrical amperes. The short circuit rating must be based upon actual tests at the rated short-circuit current for six (6) cycles. The busway shall be so designed and tested that at rating no part shall exceed a fifty-five (55) degree C. rise based on a forty (40) degree C. maximum ambient temperature.

G. Three-phase line-to-line voltage drop shall not exceed 3.0 volts per hundred feet at 70% power factor concentrated load, which condition may exist during motor starting. The voltage drop (input voltage minus output voltage) specified shall be based on the busway operating at full rated current and at stabilized operating temperature in 35-degree C. ambient temperature.

H. The busway shall be UL listed to meet two-hour fire ratings for gypsum wallboard construction and three-hour fire rating for poured concrete or concrete block construction.

Part 3 - Execution

I. EXAMINATION

A. Verify that field measurements are as shown on drawings.

B. Verify that the ratings of busway system components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive busway and associated supports.

D. Verify that conditions are satisfactory for installation prior to starting work.

II. INSTALLATION

A. The feeder busway shall be installed in accordance with the manufacturer's recommendations/instructions, NEMA publication BU1.1 (which shall be shipped with the busway) and the NEC.

B. Busway shall be run as tight as possible to the underside of the building structure and shall be carefully coordinated with all piping, ductwork, other trades and the building structure. Install busway expansion fittings at each location where busway crosses a building expansion joint. Extra care shall be taken to ensure that all components of each busway system remain dry and free from foreign matter during the construction period. Final field measurements shall be made by this Contractor prior to release of the busway for

fabrication.

C. Busway supports shall not terminate or be fastened directly to the roof decking except where specifically approved by the Owner. Busway shall not be supported from the bottom cord of joists unless specifically approved, in writing, by the Structural Engineer of record.

III. TESTING

A. Standard factory tests shall be performed on the equipment provided under this specification section. All tests shall be in accordance with the latest version of ANSI and NEMA standards. The manufacturer shall provide three (3) copies of factory test reports.

B. After completion of each busway system, and prior to energizing, the entire system shall be tested by an independent testing laboratory to ensure that phasing is correct and that there are no electrical faults present. This Contractor shall notify the Architect/Engineer and the Owner two (2) weeks prior to the date the test will performed. Costs associated with this test shall be the responsibility of this Contractor.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work under this Section shall include furnishing and installing prefabricated feeder busway distribution system(s) including all necessary fittings, hangers, and accessories as shown on the Drawings and herein specified.

III. ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the arrangement of busway with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others. Coordinate the work with other trades to avoid installation of obstructions within busway required clearances.

2. Coordinate arrangement of busway with the dimensions and clearance requirements of the actual equipment to be installed.

3. Coordinate the work with placement of supports, anchors, etc. required for mounting.

4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.

5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

6. Preinstallation Meeting: Convene one week prior to performing field measurements for busway fabrication drawings; require attendance of all affected installers. Review proposed routing, sequence of installation, and protection requirements for installed busway.

7. Sequencing: Perform field measurements prior to busway fabrication.

IV. SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for busway system components and accessories. Include dimensions, weight, materials, fabrication details, finishes, and service condition requirements. Indicate voltage and current ratings, short circuit current ratings, configurations, and installed features and accessories.

1. Include busway resistance, reactance, and impedance data and voltage drop ratings.

2. Include characteristic trip curves for each type and rating of circuit breaker plug-in device upon request.

3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.

4. Include documentation of listed series ratings upon request.

B. Field Quality Control Test Reports.

1. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

2. Project Record Documents: Record actual routing of busway. Include actual installed locations of plug-in units.

3. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

a) Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

b) See Division 1 - Product Requirements, for additional provisions.

c) Hook Stick(s) for Plug-In Units With Hook Stick Operable Handles: One, with length as required for suitable operation of plug-in unit handle from floor or working platform

V. QUALITY ASSURANCE

A. All equipment, materials, and their installation shall conform to the requirements of the National Electrical Code (NEC), local code requirements, and these Specifications.

B. All equipment and materials shall be listed by Underwriter's Laboratories, Inc. (UL) for their intended use and shall bear the UL label.

C. Equipment shall be constructed in accordance with National Electrical Manufacturer's Association (NEMA) standards.

D. All of the busway components shall be of the same manufacturer and be of the same manufacturer as the switchboard, see SECTION 262413.

E. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

F. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience with busway systems of similar size, type, and complexity.

G. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

H. Submittals are required in accordance with Division 1 of these Specifications. Submittals shall include, but not be limited to the following:

1. Product data to include all dimensions, weights, electrical ratings, wiring diagrams, required clearances, fittings, hangers and accessories.

2. A dimensioned isometric drawing, prepared by the manufacturer, for each feeder busway system showing the layout for and identification of all required components, including hanger spacing.

3. Cable terminal sizes and ratings.

VI. DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store busway in accordance with manufacturer's instructions, NECA 408, and NEMA BU1.1.

B. Store products indoors in a clean, dry space having a uniform temperature to prevent condensation. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle products carefully to avoid damage to internal components, enclosure, and finish.

VII. FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

Part 2 - Products

I. MATERIALS AND COMPONENTS

A. This Contractor shall furnish and install prefabricated feeder busway distribution system(s) as shown on the Drawings and as specified herein including all necessary fittings, hangers, and accessories. The feeder busway distribution system(s) shall consist of standard ten (10) foot sections with special sections and fittings provided to suit the installation. Horizontal runs shall be suitable for hanging on ten (10) foot maximum support centers. On vertical runs, one (1) adjustable vertical hanger per floor shall be furnished and installed. The feeder busway shall meet the latest applicable standards of NEMA, ANSI, and UL 857.

B. Busway shall be 277/480 volt, three phase, four wire with 100% neutral and 50% capacity integral (housing) and/or internal ground bus as manufactured by CUTLER-HAMMER, GENERAL ELECTRIC, SIEMENS, or SQUARE D. Feeder busway

ampere rating shall be as noted on the Drawings.

C. The busway shall be of the low impedance type, totally enclosed and non- ventilated for protection against mechanical damage and dust accumulation. The housing shall meet NEC requirements and shall be a 2-piece design fabricated from extruded aluminum. The 2-piece housing shall be bolted together along with bottom flange using grade 5, ¼ x 20 zinc-plated fasteners on 3-inch centers for maximum mechanical strength. The busway enclosure finish shall be ANSI 61 gray baked epoxy powder paint applied by an electrostatic process.

D. Each busway section shall be furnished complete with joint hardware and covers. The joints shall be a single-bolt, non-rotating, removable bridge design. All bridge joints shall be furnished with torque-indicating double head joint bolts and Belleville washers. The bridge joint shall ensure proper installation without the use of a torque wrench. Each joint shall allow for a minimum length adjustment of +\- 0.5 inches. De-energization of busway shall not be required for safe testing of joint tightness. Access to only one side of the busway shall be required for tightening or inspection of the joint. Joint covers shall be provided with captive hardware. It shall be possible to remove any joint connection assembly to allow electrical isolation or physical removal of a busway length without disturbing adjacent busway lengths.

E. Bus bars shall be fabricated from high strength 98% conductivity copper and suitably plated at all electrical contact surfaces. Bus bars shall be insulated over their entire length, except at joints and contact surfaces, with an UL listed insulating material consisting of epoxy applied by fluidized bed process or electrostatically applied Class B (130-degree C. certified) epoxy insulation. Busway shall be of sandwich construction meaning no air gap shall exist between bus bars except at the joints. Bus bars shall be tin plated at all contact surfaces.

F. Busway[1] shall be braced to withstand engineer recommended maximum RMS symmetrical amperes. The short circuit rating must be based upon actual tests at the rated short-circuit current for six (6) cycles. The busway shall be so designed and tested that at rating no part shall exceed a fifty-five (55) degree C. rise based on a forty (40) degree C. maximum ambient temperature.

G. Three-phase line-to-line voltage drop shall not exceed 3.0 volts per hundred feet at 70% power factor concentrated load, which condition may exist during motor starting. The voltage drop (input voltage minus output voltage) specified shall be based on the busway operating at full rated current and at stabilized operating temperature in 35-degree C. ambient temperature.

H. The busway shall be UL listed to meet two-hour fire ratings for gypsum wallboard construction and three-hour fire rating for poured concrete or concrete block construction.

Part 3 - Execution

I. EXAMINATION

A. Verify that field measurements are as shown on drawings.

B. Verify that the ratings of busway system components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive busway and associated supports.

D. Verify that conditions are satisfactory for installation prior to starting work.

II. INSTALLATION

A. The feeder busway shall be installed in accordance with the manufacturer's recommendations/instructions, NEMA publication BU1.1 (which shall be shipped with the busway) and the NEC.

B. Busway shall be run as tight as possible to the underside of the building structure and shall be carefully coordinated with all piping, ductwork, other trades and the building structure. Install busway expansion fittings at each location where busway crosses a building expansion joint. Extra care shall be taken to ensure that all components of each busway system remain dry and free from foreign matter during the construction period. Final field measurements shall be made by this Contractor prior to release of the busway for fabrication.

C. Busway supports shall not terminate or be fastened directly to the roof decking except where specifically approved by the Owner. Busway shall not be supported from the bottom cord of joists unless specifically approved, in writing, by the Structural Engineer of record.

III. TESTING

A. Standard factory tests shall be performed on the equipment provided under this specification section. All tests shall be in accordance with the latest version of ANSI and NEMA standards. The manufacturer shall provide three (3) copies of factory test reports.

B. After completion of each busway system, and prior to energizing, the entire system shall be tested by an independent testing laboratory to ensure that phasing is correct and that there are no electrical faults present. This Contractor shall notify the Architect/Engineer and the Owner two (2) weeks prior to the date the test will performed. Costs associated with this test shall be the responsibility of this Contractor.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work under this Section shall include furnishing and installing prefabricated track busway distribution system(s) including all necessary fittings, hangers, and accessories as shown on the Drawings and herein specified.

B. The system is primarily for overhead distribution of electrical power to support designated work areas and equipment. Once installed, the busway will provide a simple, versatile, fast and economic means of distributing power. Loads fed from a variety of plug-in units can be easily added or removed without shutting power down to the busway.

III. ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the arrangement of busway with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others. Coordinate the work with other trades to avoid installation of obstructions within busway required clearances.

2. Coordinate arrangement of busway with the dimensions and clearance requirements of the actual equipment to be installed.

3. Coordinate the work with placement of supports, anchors, etc. required for mounting.

B. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.

C. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

D. Preinstallation Meeting: Convene one week prior to performing field measurements for busway fabrication drawings; require attendance of all affected installers. Review proposed routing, sequence of installation, and protection requirements for installed busway.

E. Sequencing: Perform field measurements prior to busway fabrication.

IV. SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for busway system components and accessories. Include dimensions, weight, materials, fabrication details, finishes, and service condition requirements. Indicate voltage and current ratings, short circuit current ratings, configurations, and installed features and accessories.

1. Include busway resistance, reactance, and impedance data and voltage drop ratings.

2. Include characteristic trip curves for each type and rating of circuit breaker plug-in device upon request.

3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.

4. Include documentation of listed series ratings upon request.

B. Field Quality Control Test Reports.

1. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

2. Project Record Documents: Record actual routing of busway. Include actual installed locations of plug-in units.

3. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

4. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

a) See Division 1 - Product Requirements, for additional provisions.

b) Hook Stick(s) for Plug-In Units With Hook Stick Operable Handles: One, with length as required for suitable operation of plug-in unit handle from floor or working platform

c) Extra Plug-In Unit(s)

V. QUALITY ASSURANCE

A. All equipment, materials, and their installation shall conform to the requirements of the National Electrical Code (NEC), local code requirements, and these Specifications.

B. All equipment and materials shall be listed by Underwriter's Laboratories, Inc. (UL) for their intended use and shall bear the UL label.

C. Equipment shall be constructed in accordance with National Electrical Manufacturer's

Association (NEMA) standards.

D. All of the busway components shall be of the same manufacturer and be of the same manufacturer as the switchboard, see SECTION 262416.

E. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

F. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience with busway systems of similar size, type, and complexity.

G. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

H. Submittals are required in accordance with Division 1 of these Specifications. Submittals shall include, but not be limited to the following:

1. Product data to include all dimensions, weights, electrical ratings, wiring diagrams, required clearances, fittings, hangers and accessories.

2. A dimensioned isometric drawing, prepared by the manufacturer, for each feeder busway system showing the layout for and identification of all required components, including hanger spacing.

3. Cable terminal sizes and ratings.

VI. DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store busway in accordance with manufacturer's instructions, NECA 408, and NEMA BU1.1.

B. Store products indoors in a clean, dry space having a uniform temperature to prevent condensation. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle products carefully to avoid damage to internal components, enclosure, and finish.

VII. QUALITY ASSURANCE

A. All equipment, materials, and their installation shall conform to the requirements of the National Electrical Code (NEC), local code requirements, and these Specifications.

B. All equipment and materials shall be listed by Underwriter's Laboratories, Inc. (UL) for their intended use and shall bear the UL label.

C. Equipment shall be constructed in accordance with National Electrical Manufacturer's Association (NEMA) standards.

D. The manufacturer of the assembly shall be the manufacturer of the major components

within the assembly.

E. Submittals are required in accordance with SECTION 16010 of these Specifications. Submittals shall include, but not be limited to the following:

1. Product data to include all dimensions, weights, electrical ratings (to include short-circuit rating, voltage and continuous current), wiring diagrams, power details, required clearances, fittings, hangers and accessories.

2. Circuit breaker and cable schedule include cable lengths, plug-in unit schedules with type and quantity of devices (if applicable).

3. A dimensioned drawing, prepared by the manufacturer, for each track busway system showing the layout for and identification of all required components, including hanger spacing.

4. Cable terminal sizes and ratings.

5. Component list.

VIII. DELIVERY, STORAGE AND HANDLING

A. Refer to NEMA Publication BU1.1, which is a guide for proper installation, operation and maintenance of busway products.

B. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

C. Utilize factor provisions for all lifting, rigging, or hoisting.

D. Prior to installation, busway and busway equipment shall be stored in a temperature and humidity controlled dry environment.

IX. WARRANTY

A. This Contractor shall deliver the work in first-class operating condition in every respect. This Contractor shall also warrant that the material, equipment, and workmanship furnished shall be entirely free from defects. Any materials, equipment, or workmanship in which defects may develop before or during the warranty period shall be repaired or replaced at the Contractors own expense. Refer to SECTION 01740 for the start of the warranty period. This Contractor shall further warrant that all material, equipment, and workmanship used in the installation, but not specifically mentioned in the Drawings and Specifications, is the best of their respective kinds and that the construction and installation was performed in accordance with the best accepted standard practices in all details.

Part 2 - Products

I. MANUFACTURERS

A. The track busway shall be STARLINE Track Busway manufactured by Universal Electric Corp. or approved equal. Such firms shall be regularly engaged in the manufacture of track busway system equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years. Any product other than those listed in this specification must be pre-approved in accordance with these specifications as hereinbefore described in SECTION 16010.

II. RATINGS

A. The track busway shall be rated for 120/208 volt, three phase, four wire with 100% neutral and 100% capacity integral (housing) ground.

B. The track busway shall have a minimum of 3-cycle short-circuit rating of 22 kA RMS symmetrical rating.

C. Three-phase line-to-line voltage drop shall not exceed 1.0 volt per forty-seven (47) feet at 80% power factor for a distributed load at 225 amperes.

III. MATERIALS AND COMPONENTS

A. This Contractor shall furnish and install prefabricated track busway distribution system(s) as shown on the Drawings and as specified herein including all necessary plug-in units, cables, fittings, hangers, accessories, etc.

B. The track busway sections shall have an extruded aluminum housing containing solid copper busbars. Aluminum busbars are not permitted. The housing shall act as a 100% ground and shall provide a polarizing feature to avoid incorrect installation of plug-in units. Busbars shall be enclosed in a continuous insulator, with openings sufficient for the plug-in units to make contact. Busbars shall be sized to handle 100% of its rating continuously with ambient temperatures below 40° C / 104° F.

C. Track busway housing sections shall be five (5), ten (10), or twenty (20) feet standard lengths. The housing shall be extruded with slots to receive rod mount hangers to hang from the building structure. The housing shall a continuous access slot opening on the bottom to accept plug-in units anywhere along its length. This opening shall pass the UL hypothetical finger probe test.

D. The ampere ratings, approximate footage, fittings, plug-in units, etc. shall be as shown on the Drawings.

E. Busbar connections shall be provided, consisting of copper stabs protruding from one end of each busway section. The stabs shall insert into the opposite end of the next section, and use a tool provided by the manufacturer to make a compression fit into the busbar channel for a reliable connection.

F. Housing couplers shall be provided with adequate mechanical strength so that busway and couplers will support up to 100 pounds per 10-foot interval, with 10-foot hanger spacing. Housing couplers shall be secured in place with bolts provided by the manufacturer.

G. End caps shall be provided and installed at the ends of each track busway run.

H. Closure strips shall be provided, cut and fitted to cover the continuous access slot bottom opening of the track busway housing to prevent dust and debris from gathering in the track busway.

I. Power feed connections with junction boxes, end caps, ells, tees and special fittings shall be provided as necessary and as shown on the Drawings to complete the system

J. Plug-in units shall be of the types and electrical ratings indicated in the Drawings, with UL listing where applicable. Units shall consist of a plug head assembly design to fit into the access slot of the busway sections, and rotate 90 degrees to make the electrical connection. Units shall be polarized, to avoid incorrect installation. Each plug stab shall have wire color coding indicated on the unit. A grounded junction box shall be provided on the plug-in unit. Direct wire connections, fusing, circuit breakers or other circuit protection devices, shall be provided as required. The units shall have locking clips or bolt-on tabs to secure units to the busway. Circuit breakers and fuses in plug-in units shall have a minimum interrupting rating of 22 kA.

K. Cord grips and fittings, drop cord assemblies, and other electrical devices shall be furnished as indicated on the Drawings and specified herein. Plug-in units that include drop cords shall be manufactured with cord grips and receptacles.

L. Busway whole run metering:

1. An electronic power meter equivalent to STARLINE Model No. CPM6 Critical Power Monitor shall be mounted in busway end power feed units to monitor power utilization for each busway run, where shown on the Drawings.

2. Electronic power meter shall have a digital display showing real-time information about critical power parameters for each phase. Each phase shall be visible on the display simultaneously.

3. The electronic power meter shall comply with ANSI C12.20 for power utilization and quality with an accuracy of 0.5 percent.

4. The electronic power meter shall be capable of monitoring the following parameters: Input Voltages (L-L/L-N); current per phase (max/min); voltage per phase (max/min); neutral current; power factor; frequency; active (real), reactive and apparent power; demand (kWh); current demand; and current peak demand.

5. The electronic power meter shall communicate in RS-485 or Ethernet or wireless mesh network or web interface, Modbus RTU or SNMP. Provide all necessary

communication hubs, modules, software, etc. for complete remote monitoring capabilities.

Part 3 - Execution

I. INSTALLATION

A. The track busway and accessories shall be installed in accordance with the manufacturer's recommendations/instructions, NEMA publication BU1.1 and the National Electrical Code.

B. Track Busway shall be hung using manufacturer’s hangers and Contractor furnished all thread rods secured to the building structure. The rod mount hangers shall connect the track busway to the all thread. The maximum spacing is ten (10) feet on center for the hangers. The height of the track busway shall be as shown on the Drawings. The busway runs shall be routed as shown on the Drawings and carefully coordinated with all piping, ductwork, other trades and the building structure. Final field measurements and coordination shall be made by this Contractor prior to release of the busway for fabrication.

C. Busway supports shall not terminate or be fastened directly to roof decking. Busway shall not be supported from the bottom cord of joists unless specifically approved, in writing, by the Structural Engineer of record.

D. Extra care shall be taken to ensure that all components of each busway system remain dry and free from foreign matter during the construction period.

II. ADJUSTMENTS AND CLEANING

A. Set field-adjustable trip devices per coordination study.

B. Clean exposed surfaces using manufacturer recommended materials and methods. Touch-up damaged coating and finishes using non-abrasive material and methods recommended by the manufacturer. Eliminate all visible evidence of repair.

III. TESTING

A. Perform testing on all busway runs per NEMA publication BU1.1 and manufacturer’s recommendations prior to energizing.

IV. STARTUP SERVICES

A. A factory authorized service representative shall perform all startup services.

V. TRAINING

A. This Contractor shall provide four (4) hours of technical service training to the Owner’s technical and maintenance staff.

B. This Contractor shall provide six (6) hours of operating, programming and software

training to the Owner's operating staff. Training shall be scheduled at the Owner's convenience during the warranty period.

C. All training specified herein shall be performed by a factory certified technician.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include furnishing and installing Cartridge fuses rated 600-V ac and less complete for all electrical systems and a spare fuse cabinet as shown on the Drawings and herein specified.

III. SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material dimensions, descriptions of individual components. Include the following for each fuse type indicated:

1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

    a) For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.

    b) Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.

3. Current-limitation curves for fuses with current-limiting characteristics.

4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse. Coordination charts and tables and related data.

5. Fuse sizes for elevator feeders and elevator disconnect switches.

B. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Ambient temperature adjustment information.

2. Current-limitation curves for fuses with current-limiting characteristics.

3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.

4. Coordination charts and tables and related data.

IV. QUALITY ASSURANCE

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer. Comply with UL 248-1.

B. All equipment, materials, and their installation shall conform to the requirements of the National Electrical Code (NEC), local code requirements, and these Specifications.

1. All equipment and materials shall be listed by Underwriters Laboratories, Inc. (UL) for their intended use and shall bear the UL label. Comply with UL 248-11 for plug fuses.

2. Equipment shall be constructed in accordance with National Electrical Manufacturer's Association (NEMA) standards. Comply with NEMA FU 1 for cartridge fuses

3. Submittals are required in accordance with SECTION 16010 of these Specifications.

V. COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

Part 2 - Products

I. MATERIALS AND COMPONENTS

A. Fuses shall be listed and meet UL and/or NEMA Standards for Class K5, J, L, and RK1 fuses, or as indicated on the Drawings.

B. Dual element cartridge fuses shall be Class K5, or as indicated on the Drawings, high interrupting capacity with current limiting effect, 200,000 ampere RMS symmetrical at rated voltage minimum, and a minimum time delay of ten (10) seconds at five hundred

percent (500%) load. Unless otherwise indicated on Drawings, Class K-5 fuses shall be used for individual motor circuit protection, for motor control centers, and motor starter panelboard protection.

C. Class J and L fuses shall be provided as indicated on the Drawings for protection of non-motor loads.

D. Fuse voltage rating shall be 250 volts for 120/208-volt system and 480 or 600 volts for 277/480-volt system.

E. Fuses shall be as manufactured by COOPER BUSSMANN, GENERAL ELECTRIC, LITTLEFUSE or MERSEN (FERRAZ SHAWMUT), or EDISON FUSE, Inc..

F. Fuses over 600 amps up to 6,000 amps shall be UL Class 'L' time-delay fuses equal to BUSSMANN "HI-CAP" KRP-C. The fuses shall hold five hundred percent (500%) of rated current for a minimum of four (4) seconds and clear twenty (20) times rated current in .01 seconds or less.

G. Fuses up to 600 amps used for service entrance equipment shall be UL Class RK1 dual-element fuses equal to BUSSMANN "LOW-PEAK" LPN-RK for 250 volts or LPS-RK for 600 volts. The fuses shall hold five hundred percent (500%) of rated current for a minimum of ten (10) seconds.

H. Fuses protecting other than service entrance equipment rated over 100 amps up to 600 amps shall be UL Class K5 dual-element fuses equal to BUSSMANN "FUSETRON" FRN-R for 250 volts or FRS-R for 600 volts unless otherwise noted on the Drawings.

I. Fuses 100 amps and under shall be UL Class K5 dual-element fuses equal to BUSSMAN "FUSETRON" FRN-R for 250 volts or FRS-R for 600 volts unless otherwise noted on the Drawings.

II. PLUG FUSES

A. Characteristics: UL 248-11, nonrenewable plug fuses; 125-V ac.

B. PLUG-FUSE ADAPTERS

1. Characteristics: Adapters for using Type S, rejection-base plug fuses in Edison-base fuseholders or sockets; ampere ratings matching fuse ratings; irremovable once installed.

III. SPARE FUSE CABINET

A. All spare fuses shall be stored in their original cartons in the existing spare fuse cabinet furnished and installed by this Contractor. The cabinet shall be steel, surface mounted,

with a hinged door and flush lock, finished with gray baked enamel, and sized as required to house all spare fuses. A directory listing type and location of each fuse shall be mounted on the inside of the door. Spare fuse cabinet shall be similar to BUSSMANN Cat. No. SFC.

Part 3 - Execution

I. INSTALLATION

A. This Contractor shall furnish and install all fuses required for the electrical equipment furnished under this Division of these Specifications including all fusible safety switches, switchboards, distribution panels, motor control centers, etc.

B. Fuses shall be of the proper size, type and ampere rating required by the device accepting the fuses. The use of fuse reducers will not be allowed.

C. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

D. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

E. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

F. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

G. Proceed with installation only after unsatisfactory conditions have been corrected.

II. FUSE APPLICATIONS

A. Plug Fuses:
1. Motor Branch Circuits: Type S, dual-element time delay.

III. SPARE FUSES

A. This Contractor shall provide one set of spare fuses for every set installed and shall be stored in the original boxes in the spare fuse cabinet.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work under this Section shall include furnishing and installing enclosed circuit breakers and/or molded case switches as shown on the Drawings and herein specified.

III. QUALITY ASSURANCE

A. All equipment, materials, and their installation shall conform to the requirements of the National Electrical Code (NEC), local code requirements, and these Specifications.

B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

C. All equipment and materials shall be listed by Underwriter's Laboratories, Inc. (UL) for their intended use and shall bear the UL label.

D. Equipment shall be constructed in accordance with National Electrical Manufacturer's Association (NEMA) standards.

E. Submittals are required in accordance with Division 1 of these Specifications. The manufacturer shall furnish, but not be limited to the following:

1. Circuit breaker enclosure with dimensions and nameplate designation.

2. Circuit breaker trip ratings and frame sizes.

3. Conduit entry/exit locations.

4. Assembly ratings, including short-circuit rating, voltage, and continuous current rating.

5. Cable terminal sizes.

6. Product data.

IV. DELIVERY, STORAGE AND HANDLING

A. Deliver material and products in factory labeled packages. Store and handle in strict compliance with manufacturer’s instructions and recommendations.

B. Each unit shall be delivered in individual shipping cases and individually wrapped for protection.

C. Store in a clean, dry space. Maintain factory protection and /or provide an additional heavy canvas or heavy plastic cover to protect equipment from dirt, water, construction debris, and traffic. Where applicable, provide adequate heating within enclosures to prevent condensation.

D. Handle carefully to avoid damage to panelboards internal components, enclosure and finish.

Part 2 - Products

I. MANUFACTURERS

A. The enclosed circuit breaker(s) shall be as manufactured by CUTLER-HAMMER, GENERAL ELECTRIC, SIEMENS, or SQUARE D.

II. MATERIALS AND COMPONENTS

A. Enclosed circuit breakers shall be furnished and installed by this Contractor as shown on the Drawings. Enclosed circuit breakers shall be UL listed.

B. Enclosed circuit breakers required and/or noted on the Drawings to be "four wire" shall be furnished by the manufacturer complete with a solid neutral assembly.

C. Enclosed circuit breaker enclosures shall generally be NEMA 1 or NEMA 3R (rainproof) for exterior locations, or where noted "WP" on the Drawings.

III. CIRCUIT BREAKERS

A. Electrical circuits shall be protected by molded case circuit breakers as indicated on the Drawings.

B. The circuit breakers shall be operated by a toggle type handle and shall have a quick-make, quick-break over-center switching mechanism that shall be mechanically trip free from the handle so that the contacts cannot be held closed against short circuits and abnormal currents. Tripping due to overload or short circuit shall be clearly indicated by the handle automatically assuming a position midway between the manual "ON" and "OFF" positions. All latch surfaces shall be ground and polished. All poles of a multi-pole breaker shall be so constructed that they open, close, and trip simultaneously.

C. The circuit breakers shall be completely enclosed in a molded case. Non-interchangeable trip breakers shall have their covers sealed; interchangeable trip breakers shall have the trip unit sealed to prevent tampering. Ampere ratings shall be clearly visible. Contacts shall be non-welding silver alloy. Arc extinction shall be

accomplished by means of arc chutes consisting of metal grids mounted in an insulating support. Breakers shall be of the bolt-on type; plug-in, plug-on, blow-on, and clamp-on circuit breakers shall not be acceptable.

D. Circuit breakers shall be 80% rated unless indicated on the Drawings to be 100% rated.

E. For short circuit studies in projects, circuit breakers shall have a minimum symmetrical interrupting capacity as indicated on the Drawings. The interrupting ratings of the circuit breakers shall be at least equal to, or greater than, the available short circuit at the line terminals and not less than those values shown on the Drawings and specified in this specification section or as determined by the Short-Circuit Coordination Study whichever is higher.

F. Circuit breakers shall be listed with UL, conform to the applicable requirements of the latest issue of NEMA Standards Publication No. AB1.

G. Circuit breakers shall have thermal-magnetic trip units, with inverse time-current characteristics, unless otherwise noted on the Drawings.

1. Automatic operation of all circuit breakers shall be obtained by means of thermal-magnetic tripping devices located in each pole providing inverse time delay and instantaneous circuit protection. Instantaneous pick-up settings for each phase shall be adjustable on all frames 250A and above.

2. Circuit breakers shall be ambient compensating in that, as the ambient temperature increases over 40 C, the circuit breaker automatically derates itself to better protect its associated conductor.

3. Circuit breakers 250A and above shall have thermal magnetic interchangeable trip units.

H. Circuit breaker frames 400 ampere and above shall have microprocessor-based RMS sensing trip units on 480 volt systems and on 208 volt systems where indicated on the Drawings.

1. Solid State sensing shall measure true RMS current with capability to measure through to the 21st harmonic. Automatic operation of all circuit breakers shall be obtained by means of solid state tripping elements providing inverse time delay and instantaneous and short-time circuit protection. Continuous current rating shall be adjustable from 20% to 100% of trip unit rating. Long-time delay and instantaneous trip ratings shall also be adjustable. The short time pick-up trip shall have adjustable pick-up settings at definite times and with I2t delay.

2. Long time current adjustment shall be possible without the need for a rating plug.

3. Where specifically indicated on the Drawings, enclosed circuit breakers shall be provided with integral ground fault protection. Ground fault pick- up shall be

adjustable from 20% to 70% of the breakers maximum continuous current rating, but in no case be greater than 1200A. Ground fault time delay shall be adjustable with three (3) I2t delay settings.

4. Solid State circuit breakers shall have built-in test ports for testing the long-time delay, instantaneous, and ground fault functions (if equipped) of the breaker by means of a test set.

5. Provide one test set capable of testing all circuit breakers with a built-in test port, unless previously provided under another section of these specifications.

I. Circuit breaker accessories:

1. Provide shunt-trips, bell alarms and auxiliary switches, etc. as may be shown on the drawings. All accessories shall be UL Listed for field installation.

2. Coils for the shunt-trip circuit breakers associated with the elevator shut- down system, activated by the Fire Alarm and Detection System shall be coordinated with the Fire Alarm and Detection System for the proper coil voltage of the shunt-trip device.

J. Circuit breakers shall be manufactured by the same manufacturer as the panelboards and the circuit breaker enclosure and be factory installed.

K. Lugs shall be rated for 75 degrees C terminations and shall bolt in place.

L. As required, circuit breakers shall be UL listed for series application where indicated.

IV. MOLDED CASE SWITCHES

A. Where indicated on the Drawings provide enclosed molded case switches. Molded case switches shall employ the same operating mechanism as the thermal magnetic and magnetic only circuit breaker units described above. The molded case switch shall have a factory preset instantaneous function to allow the switch to trip and protect itself at a high fault current, without thermal overload protection.

V. NAMEPLATES

A. Enclosed circuit breakers and or molded case switches, including exterior locations, shall have nameplates of 1/16-inch-thick laminated plastic with 3/16-inch-high white letters on a black background. Nameplates shall identify each piece of equipment and shall be mounted on the front top of the enclosure. Nameplates shall be screw fastened using stainless steel screws.

Part 3 - Execution

I. INSTALLATION

A. The enclosed circuit breakers shall be securely mounted in accordance with the NEC, approximately forty-eight (48) inches but no less than twelve (12) inches above the finished floor to the bottom unless otherwise noted.

B. Mounting brackets and hardware exposed to weather shall be galvanized or otherwise suitably protected from corrosion.

C. Install units plumb, level and rigid without distortion to the units.

D. Contractor shall install required safety labels.

II. FIELD TESTS

A. Check tightness of all accessible mechanical and electrical connections to assure they are torqued to the minimum acceptable manufacturer's recommendations.

B. Check all enclosed circuit breakers and enclosures for proper grounding, fastening and alignment.

III. FIELD ADJUSTMENTS

A. This Contractor shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. Necessary field settings of devices and adjustments and minor modifications to equipment shall be carried out by this Contractor at no additional cost to the Owner.

B. As required, The settings shall be in accordance with the approved protective device coordination study or as directed by the Engineer.

IV. CLEANING

A. Remove debris from enclosed circuit breaker enclosures and wipe dust and dirt from all components.

B. Repaint marred and scratched surfaces with touch-up paint to match original finish.

END OF SECTION

Disconnect Switches Section 262818

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work under this Section shall include furnishing and installing safety switches and/or bolted pressure switches as shown on the Drawings and herein specified.

III. SUBMITTALS

A. Product Data: For each type of disconnect switch, enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.

2. Current and voltage ratings.

3. Short-circuit current ratings (interrupting and withstand, as appropriate).

4. Include evidence of NRTL listing for series rating of installed devices.

5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

7. Submit the results of coordination and short circuit study along with this submission.

B. Shop Drawings: For disconnect switches, enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

IV. QUALITY ASSURANCE

A. All equipment, materials, and their installation shall conform to the requirements of the National Electrical Code (NEC), local code requirements, and these Specifications.

B. Source Limitations: Obtain disconnect switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

C. All equipment and materials shall be listed by Underwriter's Laboratories, Inc. (UL) for

their intended use and shall bear the UL label.

D. Equipment shall be constructed in accordance with National Electrical Manufacturer's Association (NEMA) standards.

E. Submittals are required in accordance with SECTION 16010 of these Specifications.

F. Product Selection for Restricted Space: Drawings indicate maximum dimensions for disconnect switches, enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

Part 2 - Products

I. SAFETY SWITCHES

A. This Contractor shall furnish and install where shown on the Drawings, heavy- duty type safety switches. Safety switches shall be NEMA heavy-duty type HD only and shall be UL listed. The heavy-duty safety switches shall be manufactured by CUTLER-HAMMER, GENERAL ELECTRIC, SIEMENS, or SQUARE D.

B. Type HD, Heavy Duty, Single Throw, 240, or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Double Throw, 240 or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Switches shall have a quick-make and quick-break operating handle and mechanism that shall be an integral part of the enclosure. Switches shall be horsepower rated 250 volt for 120/208 volt systems or 600 volt for 277/480-volt system. The lugs shall be UL listed for copper conductors and be front removable. Ampere ratings shall be as indicated on the Drawings.

E. Safety switches required and/or noted on the Drawings to be "four wire" shall be furnished by the manufacturer complete with a solid neutral assembly.

F. Safety switches shall have defectable door interlocks that prevent the door from opening when the handle is in the “ON” position. Defeater mechanism shall be front accessible.

G. Enclosures for the switches shall generally be NEMA 1 or NEMA 3R (rainproof) for exterior locations, or where noted "WP" on the Drawings.

II. BOLTED PRESSURE SWITCHES

A. This Contractor shall furnish and install where shown on the Drawings, true bolted contact load-break type switches with provisions for NEMA Class L fuses (fuses shall be furnished and installed by this Contractor). The stored energy deadfront operating

mechanism shall include disk springs, compressed and released by the operating handle, to provide quick-positive switching action independent of the speed with which it is operated. The mechanism shall be designed so that the switch can be closed only after the opening spring has been charged, ready for manual opening by mechanical pushbutton.

B. The switch operating handle shall be mechanically interlocked with the fuse access door and have provisions for padlocking in OPEN position.

C. The switch shall have an interrupting rating of twelve (12) times the continuous rating and capable of carrying 100% of rated current and shall have been tested in accordance with UL Subject 977. The switch shall be suitable for use on circuits having available fault currents of 65,000 RMS symmetrical amperes rated (250) (600) VAC and of the ampacity shown on the Drawings. High- pressure contact switches do not meet the intent of these specifications.

D. The switch shall be complete with single phase protection to open the main device upon loss of any single phase but not upon simultaneous loss of all three (3) phases.

E. The switch shall be complete with separate blown fuse protection to open the bolted pressure switch if one or more of the Class L fuses operate. Indicating lights mounted on the front of the switch shall be included as a means of showing that the fuses have operated. Operating lights shall operate only when a fuse has blown.

F. The switch shall have two (2) sets of auxiliary contacts (2 normally open and 2 normally closed) for switch position monitoring.

G. A ground fault protection system shall be included for the bolted pressure switch as shown on the Drawings or as required by NEC.

1. The system shall consist of a current sensor enclosing all phase and neutral conductors of the circuit to be monitored, and appropriate relaying equipment to

provide the desired ground fault current sensitivity and time- current response characteristics. The switch shall be equipped to function in conjunction with the other elements of the ground fault protection system. Installation of the equipment shall be in all respects in accordance with the manufacturer's recommendations.

2. A current sensor shall be provided of the size necessary to encircle the phase conductors and the neutral conductor of the circuit to be monitored. Current sensor output shall be coordinated with the required input to the relay. A test winding shall be included to simulate the flow of ground fault current through the current sensor in order to test the operation of the ground fault protection system including sensor pick-up relay, and circuit protective device operation. The frame of the current sensor shall be so constructed that one leg can be opened to allow removal of installation around cable or bus without disturbing the cable or requiring drop-links in the bus.

3. The ground fault relay shall be of solid state construction, except that a coil operated output relay shall be provided to control 120-volt power to operate the associated fusible bolted pressure switch ground fault trip mechanism. The

relay shall require 120-volt power to operate the associated main device. Adjustable pickup current sensitivity for ground currents from 200 amperes to 1200 amperes shall be provided. A calibrated dial shall be provided for setting the current pickup point in the field. Settings for individual relays shall be 1200 amperes or as determined by the Short-Circuit Coordination Study whichever is lower. Time delay provided by the relay circuitry shall be nominally 0.2 seconds or as determined by the Short-Circuit Coordination Study and shall be permanently calibrated. A self-contained test circuit utilizing the test coil provided in the current sensor shall be incorporated in the system. The test circuit shall be part of the monitor panel that shall be mounted on the front cover of the switch.

H. The switch enclosure shall be NEMA 1, floor or wall mounted as shown on the Drawings.

I. The switch shall be manufactured by PRINGLE[1] and shall be type CBC or approved equal.

III. ENCLOSURES

A. Disconnect Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.

2. Outdoor Locations: NEMA 250, Type 3R.

3. Kitchen or Wash-Down Areas: NEMA 250, Type 4X.

4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.

5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

6. Hazardous Areas Indicated on Drawings: NEMA 250, Type 9.

IV. NAMEPLATE

A. Disconnect switches, including exterior locations, shall have nameplates of 1/16-inch-thick laminated plastic with 3/16-inch-high white letters on a black background. Nameplates shall identify each piece of equipment and shall be mounted on the front top of the enclosure. Nameplates shall be screw fastened using stainless steel screws.

B. Disconnect switches for elevator equipment shall also provide nameplates and signage to identify the location of the supply side overcurrent protective device, including circuit numbers, per NEC Article 620. Nameplates and signage shall be laminated plastic as hereinbefore described.

Part 3 - Execution

I. EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

II. INSTALLATION

A. The disconnect switches shall be securely mounted in accordance with the NEC, approximately forty-eight (48) inches but no less than twelve (12) inches above the finished floor to the bottom unless otherwise noted.

B. Mounting brackets and hardware exposed to weather shall be galvanized or otherwise suitably protected from corrosion.

1. All NEMA 3R disconnect safety switches mounting openings not used must be permanently sealed to keep rain, moisture, insects, etc. from entering the switch

housing. The use of stainless steel screws/nuts with rubber washers and silicone sealant may be used, or another approved method for a completely sealed switch housing.

C. The fuses (type and size as noted on the Drawings) as specified shall be installed in disconnect switches requiring fuses. Rejection fuse clips shall be installed where called for on the Drawings or in these Specifications. Contractor shall provide Owner attic stock of two (2) fuses per phase.

D. Contractor shall install required safety labels.

E. Comply with NECA 1.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work under this Section shall include furnishing and installing safety switches and/or bolted pressure switches as shown on the Drawings and herein specified.

III. SUBMITTALS

A. Product Data: For each type of disconnect switch, enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.

2. Current and voltage ratings.

3. Short-circuit current ratings (interrupting and withstand, as appropriate).

4. Include evidence of NRTL listing for series rating of installed devices.

5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

7. Submit the results of coordination and short circuit study along with this submission.

B. Shop Drawings: For disconnect switches, enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

IV. QUALITY ASSURANCE

A. All equipment, materials, and their installation shall conform to the requirements of the National Electrical Code (NEC), local code requirements, and these Specifications.

B. Source Limitations: Obtain disconnect switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

C. All equipment and materials shall be listed by Underwriter's Laboratories, Inc. (UL) for

their intended use and shall bear the UL label.

D. Equipment shall be constructed in accordance with National Electrical Manufacturer's Association (NEMA) standards.

E. Submittals are required in accordance with SECTION 16010 of these Specifications.

F. Product Selection for Restricted Space: Drawings indicate maximum dimensions for disconnect switches, enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

Part 2 - Products

I. SAFETY SWITCHES

A. This Contractor shall furnish and install where shown on the Drawings, heavy- duty type safety switches. Safety switches shall be NEMA heavy-duty type HD only and shall be UL listed. The heavy-duty safety switches shall be manufactured by CUTLER-HAMMER, GENERAL ELECTRIC, SIEMENS, or SQUARE D.

B. Type HD, Heavy Duty, Single Throw, 240, or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Double Throw, 240 or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Switches shall have a quick-make and quick-break operating handle and mechanism that shall be an integral part of the enclosure. Switches shall be horsepower rated 250 volt for 120/208 volt systems or 600 volt for 277/480-volt system. The lugs shall be UL listed for copper conductors and be front removable. Ampere ratings shall be as indicated on the Drawings.

E. Safety switches required and/or noted on the Drawings to be "four wire" shall be furnished by the manufacturer complete with a solid neutral assembly.

F. Safety switches shall have defectable door interlocks that prevent the door from opening when the handle is in the “ON” position. Defeater mechanism shall be front accessible.

G. Enclosures for the switches shall generally be NEMA 1 or NEMA 3R (rainproof) for exterior locations, or where noted "WP" on the Drawings.

II. BOLTED PRESSURE SWITCHES

A. This Contractor shall furnish and install where shown on the Drawings, true bolted contact load-break type switches with provisions for NEMA Class L fuses (fuses shall be furnished and installed by this Contractor). The stored energy deadfront operating

mechanism shall include disk springs, compressed and released by the operating handle, to provide quick-positive switching action independent of the speed with which it is operated. The mechanism shall be designed so that the switch can be closed only after the opening spring has been charged, ready for manual opening by mechanical pushbutton.

B. The switch operating handle shall be mechanically interlocked with the fuse access door and have provisions for padlocking in OPEN position.

C. The switch shall have an interrupting rating of twelve (12) times the continuous rating and capable of carrying 100% of rated current and shall have been tested in accordance with UL Subject 977. The switch shall be suitable for use on circuits having available fault currents of 65,000 RMS symmetrical amperes rated (250) (600) VAC and of the ampacity shown on the Drawings. High- pressure contact switches do not meet the intent of these specifications.

D. The switch shall be complete with single phase protection to open the main device upon loss of any single phase but not upon simultaneous loss of all three (3) phases.

E. The switch shall be complete with separate blown fuse protection to open the bolted pressure switch if one or more of the Class L fuses operate. Indicating lights mounted on the front of the switch shall be included as a means of showing that the fuses have operated. Operating lights shall operate only when a fuse has blown.

F. The switch shall have two (2) sets of auxiliary contacts (2 normally open and 2 normally closed) for switch position monitoring.

G. A ground fault protection system shall be included for the bolted pressure switch as shown on the Drawings or as required by NEC.

1. The system shall consist of a current sensor enclosing all phase and neutral conductors of the circuit to be monitored, and appropriate relaying equipment to provide the desired ground fault current sensitivity and time- current response characteristics. The switch shall be equipped to function in conjunction with the other elements of the ground fault protection system. Installation of the equipment shall be in all respects in accordance with the manufacturer's recommendations.

2. A current sensor shall be provided of the size necessary to encircle the phase conductors and the neutral conductor of the circuit to be monitored. Current sensor output shall be coordinated with the required input to the relay. A test winding shall be included to simulate the flow of ground fault current through the current sensor in order to test the operation of the ground fault protection system including sensor pick-up relay, and circuit protective device operation. The frame of the current sensor shall be so constructed that one leg can be opened to allow removal of installation around cable or bus without disturbing the cable or requiring drop-links in the bus.

3. The ground fault relay shall be of solid state construction, except that a coil operated output relay shall be provided to control 120-volt power to operate the associated fusible bolted pressure switch ground fault trip mechanism. The

relay shall require 120-volt power to operate the associated main device. Adjustable pickup current sensitivity for ground currents from 200 amperes to 1200 amperes shall be provided. A calibrated dial shall be provided for setting the current pickup point in the field. Settings for individual relays shall be 1200 amperes or as determined by the Short-Circuit Coordination Study whichever is lower. Time delay provided by the relay circuitry shall be nominally 0.2 seconds or as determined by the Short-Circuit Coordination Study and shall be permanently calibrated. A self-contained test circuit utilizing the test coil provided in the current sensor shall be incorporated in the system. The test circuit shall be part of the monitor panel that shall be mounted on the front cover of the switch.

H. The switch enclosure shall be NEMA 1, floor or wall mounted as shown on the Drawings.

I. The switch shall be manufactured by PRINGLE[1] and shall be type CBC or approved equal.

III. ENCLOSURES

A. Disconnect Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.

2. Outdoor Locations: NEMA 250, Type 3R.

3. Kitchen or Wash-Down Areas: NEMA 250, Type 4X.

4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.

5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

6. Hazardous Areas Indicated on Drawings: NEMA 250, Type 9.

IV. NAMEPLATE

A. Disconnect switches, including exterior locations, shall have nameplates of 1/16-inch-thick laminated plastic with 3/16-inch-high white letters on a black background. Nameplates shall identify each piece of equipment and shall be mounted on the front top of the enclosure. Nameplates shall be screw fastened using stainless steel screws.

B. Disconnect switches for elevator equipment shall also provide nameplates and signage to identify the location of the supply side overcurrent protective device, including circuit numbers, per NEC Article 620. Nameplates and signage shall be laminated plastic as hereinbefore described.

Part 3 - Execution

I. EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

II. INSTALLATION

A. The disconnect switches shall be securely mounted in accordance with the NEC, approximately forty-eight (48) inches but no less than twelve (12) inches above the finished floor to the bottom unless otherwise noted.

B. Mounting brackets and hardware exposed to weather shall be galvanized or otherwise suitably protected from corrosion.

1. All NEMA 3R disconnect safety switches mounting openings not used must be permanently sealed to keep rain, moisture, insects, etc. from entering the switch housing. The use of stainless steel screws/nuts with rubber washers and silicone sealant may be used, or another approved method for a completely sealed switch housing.

C. The fuses (type and size as noted on the Drawings) as specified shall be installed in disconnect switches requiring fuses. Rejection fuse clips shall be installed where called for on the Drawings or in these Specifications. Contractor shall provide Owner attic stock of two (2) fuses per phase.

D. Contractor shall install required safety labels.

E. Comply with NECA 1.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE OF WORK

A. The work covered under this Section shall apply to the design and supply of pad mounted, weatherproof, electric equipment enclosures that are used to house electric equipment in outdoor environments.

B. The electric equipment enclosures shall be as noted on the Contract Drawings.

III. QUALITY ASSURANCE

A. All equipment, materials, and their installation shall conform to the requirements of the National Electrical Code (NEC), local code requirements, and these Specifications.

B. All equipment and materials shall be listed by Underwriters Laboratories, Inc. (UL) for their intended use and shall bear the UL label.

C. Equipment shall be constructed in accordance with National Electrical Manufacturer's Association (NEMA) standards.

D. The supplier shall design and produce the electric equipment enclosures to meet the criteria noted in these specifications and as shown on the Drawings. The supplier shall be capable of producing a premium grade product, which meets the quality, fit and finish noted herein.

E. The cabinet shall be designed to meet the approval of the local electrical utility (if applicable) and shall be designed for ease of maintenance.

F. Submittals are required in accordance with Division 1 of these specifications. Submittals shall include but not be limited to the following:

1. Detailed cabinet and door shop drawings showing all fabrication and the layout of all internal components and equipment.

2. List of all components (by manufacturer and model number) and product sheets for each item.

Part 2 - Products

I. MANUFACTURERS

A. Acceptable Manufacturers of Electric Equipment Enclosures are: HOFFMAN ENCLOSURES, INC., NJ SULLIVAN CO. or approved equal.

B. The listing of the above manufacturers does not constitute automatic approval or final acceptance. It is the Contractor's responsibility to verify and document that any product selected from the above list does meet the requirements of the Contract Documents.

II. GENERAL MATERIAL REQUIREMENTS

A. All materials shall be new.

B. Unless otherwise noted, the cabinet shall be fabricated from 12 gauge galvanized post-fabrication, electrostatically primed and painted steel; or unpainted 12-gauge Type 304 or 316L stainless steel.

C. All materials shall be corrosion resistant for extended life.

D. Enclosures shall be rated NEMA 3R or 4X.

III. FABRICATION PROCESS

A. The cabinet and doors shall be fabricated to plus or minus 10-thousandths of an inch tolerance for proper fit.

B. All bending shall be done using a suitable break press.

IV. CONNECTING HARDWARE

A. All screws, bolts, washers, nuts, etc. shall be stainless steel.

B. All screws shall be stainless steel pan-head machine screw type.

C. No sheet metal or self-tapping screws shall be used.

V. WELDING

A. All exterior seams shall be of continuously welded construction. All welds shall be free of slag and spatter. All exterior welds shall be ground smooth.

B. The supplier shall have suitable credentials to weld steel and shall adhere to all applicable ANSI standards.

C. The supplier shall use a suitable welding process and materials.

VI. DOORS AND HINGES

A. Doors shall be designed for maximum strength and snug fit. It is the supplier's responsibility to design and fabricate the doors to the fit and finish required in this

specification.

B. Doors shall be fabricated out of a single sheet of steel and have wrap-around return for strength and fit.

C. Doors shall have a one-piece gasket to provide a tight seal against contaminants entering the cabinet.

D. Door handles shall be 3-point contact steel construction. The lever handles shall latch to the cabinet with 16-gauge stainless steel rails and rollers which shall be fabricated to provide a secure and well-sealed attachment to the cabinet. Door handles shall be designed to accept a padlock. Bolted door closures or dogs are not allowed.

E. The exterior of the doors shall have continuous welds.

F. All exterior corners shall be rounded to a minimum radius of 1/8 of an inch. All sharp edges shall be de-burred to a minimum radius of 1/64 inch in order to reduce hazards to service personnel.

G. Hinges shall be both corrosion resistant and vandal proof.

VII. CABINET

A. The cabinet and door shall be constructed to meet NEMA 3R or 4X standards. The cabinet shall be made up of the main body, roof section and inner wall. These components shall be welded together. The cabinet shall be designed for maximum strength and proper fit to the door.

B. It is the supplier's responsibility to design and fabricate the cabinet to the fit and finish required in this specification.

C. The cabinet shall be designed to attach to a concrete pad via suitable drop-in anchors, which shall be supplied with the cabinet.

D. The exterior of the cabinet shall have continuous welds.

E. The cabinet main body shall have a wrap-around return to accept the door.

F. The cabinet shall have 120V weather-resistant ground fault duplex receptacle.

G. The cabinet shall be equipped with lifting brackets, which shall be removable after installation.

H. All exterior corners shall be rounded to a minimum radius of 1/8 of an inch. All sharp edges shall be de-burred to a minimum radius of 1/64 inch in order to reduce hazards to service personnel.

VIII. EQUIPMENT MOUNTING INNER WALL

A. Equipment shall be mounted on the interior using mounts and fittings supplied with the enclosure. No penetrations of the outer enclosure shall be used to mount equipment.

B. Equipment mounting panels shall be constructed from minimum 12-gauge sheet steel with a conductive, corrosion-resistant coating. Panels shall have edge flanges on two or four sides and lifting holes.

IX. FINISH

A. Upon completion of fabrication the cabinet, door and inner wall shall be finished as follows:

1. Surfaces shall be thoroughly cleaned and degreased.

2. Painted surfaces shall receive a prime coat electrostatically applied. After the prime coat has set, the top coat shall be electrostatically applied. Color shall be ANSI Dark Green or as shown on the Drawings.

3. Stainless steel surfaces are unpainted. Front, sides, top and back shall have a smooth #4 brushed finish.

4. The final product shall be free of dents, scratches, weld burns and abrasions harmful to its strength and general appearance.

X. GENERAL ELECTRICAL

A. All equipment shall be mounted on stand-off back panels.

B. All equipment shall be labeled using Lamicoid or vinyl adhesive labels with ½-inch high black characters on a white background.

XI. METERING (WHEN REQUIRED)

A. Metering location shall meet the approval of the local utility company. The metering shall be located for easy reading by the local utility.

B. CT’s and metering cabinets shall be sized and laid out to meet the local utility company’s standards.

XII. GROUNDING

A. The grounding system shall be designed to meet all NEC standards and any codes and local utility standards.

B. The grounding system shall be designed as part of the power distribution system.

XIII. EXTERNAL LIGHTING CONTROLS – SPORTS FIELDS

A. A weatherproof NEMA 3R pad-lockable box shall be provided and located as shown on the Drawings, for an On/Off pushbutton control station furnished as part of the Sports Field Lighting Control System. This control station switch will allow users to turn the lights on or off whenever the system is enabled by the remote system, on-site digital key pad, or time clock, see Specification Section 16545. The control station enclosure box shall be suitably located on the exterior of the Electrical Equipment Enclosure.

XIV. LABELING

A. All products shall be labeled (inside) with the supplier's company name, model number, panel rating and the date of manufacture.

B. The Contractor or supplier shall also provide adhesive Lamicoid or vinyl labels on the inside of each cabinet for each component. Each incoming feeder and output circuit shall also be labeled per the electrical design Drawings.

C. All ID labels shall have ¼" to ½" high black characters on a white background.

XV. PACKAGING

A. Any product damaged in shipping shall be repaired or replaced at no cost to the Owner.

Part 3 - Execution

I. FOUNDATIONS

A. The Contractor shall provide and install concrete pads for electrical equipment enclosures and utility transformers (if applicable) as shown on the Drawings.

1. Concrete foundations for electrical equipment enclosures shall be as follows:

a) Minimum compressive strength at 28 days – 3500PSI

b) Maximum nominal aggregate size – 1 inch

c) Maximum W/C ratio by mass - 0.45

d) Air content - 5 ± 1%
e) Slump - 2" ± 0.75"

2. Top of concrete bases shall be trowel finished smooth and level with beveled edges. Top surface shall not vary by more than 1/8 inch in depth as measured across the widest surface.

3. All concrete shall be fully vibrated.

4. Reinforcing Steel – Reinforcing to meet ASTM requirements. Spacing of bars shall be adjusted to suit conduit spacing.

B. Excavated material may be used as backfill. All excess excavated material shall be disposed of off-site.

II. GROUNDING

A. Install all grounding and bonding in accordance with NEC and the Contract Documents.

III. FIELD QUALITY CONTROL

A. Inspect each installed unit for damage. Replace damaged components.

B. Any paint damage shall be repaired by spray applied or other application that matches the factory finish to the maximum extent possible. Brush or roller applied repair painting is not allowed.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include furnishing and installing the standby electrical power system consisting of an emergency engine generator set and automatic transfer switch as shown on the Drawings and herein specified.

B. The existing standby electrical power system shall remain in operation and shall continue to serve the building's emergency power during the construction period until the new system has been installed and tested, ready for operation. After the new system has assumed the building's entire emergency power load, the existing system shall be removed as shown on the Drawings.

C. Related Sections include the following:

1. Division 16 Section "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets

III. SUBMITTALS

A. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:

1. Thermal damage curve for generator.

2. Time-current characteristic curves for generator protective device.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.

2. Wiring Diagrams: Power, signal, and control wiring.

C. Qualification Data: Manufacturer shall demonstrate they manufacture either the alternator or the generator. Manufacturers that assemble, and do not manufacture the alternator or the generator shall not be permitted.

D. Source quality-control test reports.

1. Certified summary of prototype-unit test report.

2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.

3. Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria for sensitive loads.

4. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.

5. Report of sound generation.

6. Report of exhaust emissions showing compliance with applicable regulations.

7. Certified Torsional Vibration Compatibility: Comply with NFPA 110.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals.

G. Warranty: Special warranty specified in this Section.

IV. QUALITY ASSURANCE

A. All applicable parts of the standby electrical power system shall meet National Electrical Manufacturer's Association (NEMA) and National Fire Protection Association (NFPA) standards, and be Underwriter's Laboratories, Inc. (UL) listed to UL 2200 and bear the UL label. The system shall be installed to meet the requirements of the National Electric Code (NEC) and all applicable state and local codes, and these Specifications.

B. This system shall be completely built, tested, and shipped by a manufacturer who has been regularly engaged in the production of such equipment for the past ten (10) years and who has had parts and service facilities available locally (within a 50-mile radius of the job site) for the past five (5) years.

C. The supplier of the standby electrical power system shall have and shall be able to

demonstrate fully stocked service vehicles. The supplier shall also have factory trained and factory certified maintenance technicians on staff.

D. The performance of the standby electrical power system shall be certified by an independent testing laboratory as to the unit's full power rating, voltage, and frequency regulation.

E. The standby electrical power system shall provide standby for the emergency white and exit lights and other such auxiliary power as indicated on the Drawings so as to operate automatically in the event of a utility power failure of the "normal" power system.

F. Submittals are required in accordance with SECTION 16010 of the Specifications. The manufacturer shall furnish printed literature and brochures describing the standard series specified (not a one of a kind fabrication). The manufacturer shall furnish schematic and wiring diagrams for the engine generator set and automatic load transfer switch; and an interconnecting diagram showing connections to individual components which constitute the standby electrical power system.

G. The performance tests of the generating set series shall be in accordance with procedures certified by an independent testing laboratory. The manufacturer shall have successfully tested a prototype of the generating set series offered which shall include: maximum power level; maximum motor starting capacity; structural soundness; torsigraph analysis; fuel consumption; engine-alternator cooling air flow; transient response and steady state governing; alternator temperature rise per NEMA MG1-22.40; single step load pickup per NFPA 76A- 822; harmonic analysis and voltage waveform deviation; and three-phase short circuit test for mechanical and electrical strength.

H. Manufacturer Qualifications: The manufacturer of the gen set shall be either a manufacturer of the engine or the alternator. Maintain, within 200 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

I. The generator set manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

J. The manufacturer shall maintain model and serial number records for each engine generator set and automatic load transfer switch provided for at least 20 years.

K. Source Limitations: Obtain packaged generator set, automatic transfer switches and auxiliary components through one source from a single manufacturer.

V. COORDINATION

A. Coordinate size and location of concrete bases for package engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

VI. MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of manufacturer's designated service organization.

B. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

Part 2 - Products

I. DESCRIPTION

A. The standby electrical power system shall be furnished and installed by this Contractor as shown on the Drawings and as herein specified. The system shall be manufactured by CUMMINS POWER GENERATION as listed herein or equal as manufactured by CATERPILLAR (OLYMPIAN), GENERAC POWER SYSTEMS, or KOHLER POWER SYSTEMS.

B. The standby electrical power system shall be an electric plant rated for continuous standby service at 35 KW, 0.8 power factor, 277/480 volts, three phase, four wire, 60 Hertz. A standby electrical power system that will meet this specification is CUMMINS POWER GENERATION Model Number 35 GGPA. The system shall be a package of new and current equipment consisting of:

1. A natural gas fueled engine generator set, as indicated on the Drawings, to provide standby electrical power.

2. An automatic transfer switch to provide automatic starting and stopping of the engine generator set and switching of the load.

3. Mounted accessories as herein specified.

4. Three pole, 70 amp output main circuit breaker. Provide auxiliary contacts to indicate circuit breaker status.

5. Engine mounted start-stop control system.

6. Spring type vibration isolators.

II. ENGINE GENERATOR SET

A. Engine

1. The engine shall be natural gas fueled, four (4) cycle, water cooled, with natural aspiration, mounted radiator, fan, and water pump. It shall have six (6) cylinders with a minimum displacement of 305 cubic inches, with a minimum rating of 77.3-brake horsepower at operating speed of 1800 RPM. Free-turn overhead valves shall be alloy steel with hard chrome-cobalt alloy. Full pressure lubrication shall be supplied by a gear oil pump. The engine shall have a replaceable, full-flow oil filter and gaseous fuel pressure regulation and solenoid valve. Engine speed shall be governed by an electronic governor for isochronous frequency regulation. The engine shall have a twelve (12) volt, DC, battery charging alternator (70A) automatically controlled by a solid-state voltage regulator. Starting shall be by a twelve (12) volt electric starter.

2. The complete engine shall be furnished with a start control that operates on contact closing and a stop control that operates on contact opening. A cranking limiter shall be provided to open the starting circuit in approximately forty-five (45) seconds if the plant is not started within that time.

B. The alternator shall be a four (4) pole revolving field type with static exciter and torque matched voltage regulator. No commutator or commutator brushes shall be allowed. The starter shall be directly connected to the engine flywheel housing, and the rotor shall be driven through a rigid coupling to insure permanent alignment. Voltage regulation shall be within plus or minus two percent (2%) of rated voltage, from no-load to full-load. The instantaneous voltage dip shall be less than twelve percent (12%) of rated voltage when full- load and rated power factor is applied to the alternator. Recovery to stable operation shall occur within two (2) seconds. Stable or steady-state operation is defined as operation with terminal voltage remaining constant within plus or minus one (1%) percent of rated voltage. Temperature rise shall not be more than one hundred twenty-five (125) degrees F over forty (40) degrees ambient at rated load. A permanent magnet generator shall provide excitation power to the automatic voltage regulator for immunity from voltage distortion caused by non- linear SCR controlled loads on the unit. The permanent magnet generator shall sustain short circuit current for selective operation and coordination of overcurrent devices.

C. The engine generator set control panel shall be wired, tested, and shock mounted on the generator set by the manufacturer of the alternator. It shall contain: panel lighting; RUN-STOP-REMOTE selector switch; coolant temperature gauge; field circuit breaker; DC voltmeter; running time meter; lamp test switch; oil pressure gauge; fault reset switch; cycle cranking; and low coolant level shutdown. The panel shall contain a twelve (12) light monitor panel with the following: green RUN light; yellow PREWARNING FOR

LOW OIL PRESSURE light; yellow PREWARNING FOR HIGH COOLANT TEMPERATURE light; red LOW OIL PRESSURE SHUTDOWN light; red HIGH COOLANT TEMPERATURE SHUTDOWN light; red OVERCRANK SHUTDOWN light; red OVERSPEED SHUTDOWN light; flashing red SWITCH OFF light; yellow LOW COOLANT TEMPERATURE light; yellow

D. The engine generating set shall be mounted on a welded steel base which shall provide for suitable mounting by this Contractor to any level surface. This Contractor shall furnish and install vibration isolators of the number and size required for the total weight of the unit between the steel base and mounting pad.

E. Accessories required for the proper operation of the engine generator set shall be furnished by the manufacturer. These shall include, but not be limited to, the following:

1. Flexible exhaust connectors.
2. Twelve (12) volt lead acid type starting batteries.
3. Battery rack and cables.
4. Additional solenoid valve (shipped loose).
5. This Contractor shall install the additional DC voltage solenoid valve supplied, prior to the flexible fuel line and wire as directed by the engine generator manufacturer to the control circuit to open with the engine operation.
6. Flexible gas lines.
7. Gaseous fuel pressure regulator (to be supplied by the Division 15 Contractor).
8. Single phase, 1.5 kW, 120 volt crank case heater, direct connected. Plug and cord connected type will not be acceptable.
9. Fifty percent (50%) ethylene glycol antifreeze solution to fill engine cooling system.
10. Two (2) 12-volt Form C dry contacts for connection to the fire alarm system graphic annunciator panel for “Generator Run” and “Generator Fault” indications.
11. Two (2) 12-volt Form C dry contacts for connection to the security intrusion system panel for “Generator Run” and “Generator Fault” indications.

F. The engine generator set shall be enclosed with a weather protective housing. The housing shall be rated for sound attenuation of sixty-three (63) dB(A) average at seven

(7) meters when using an eight (8) position measurement system using tests conducted per ANSI S1.13-1971. Acoustical materials shall be oil and water-resistant. A critical silencer muffler shall be mounted inside the housing with raincap and rainshield. The housing shall be attached to the skid base of the generator set and constructed of minimum 14-gauge metal using non-marring fasteners. The access doors shall have both key-lockable door handles and provisions for padlocking and mounted using stainless steel hinges. Paint protection shall be epoxy primer and dual coat electrodeposition method for all sides and all metal surfaces. Overspray of hoses, clamps, wiring and harnesses, and other serviceable items shall not be acceptable.

III. AUTOMATIC TRANSFER SWITCH

A. The complete automatic transfer switch shall be suitable for utility power (source 1) to engine generator set (source 2) application, be completely factory assembled with digital electronic controls designed for surge voltage isolation, and including voltage sensors on all phases of both sources, linear operator, permanently attached manual handles, positive mechanical and electrical interlocking, and mechanically held contacts.

B. The automatic transfer switch shall conform to the requirements of the following codes and standards (latest editions):

C. UL1008. The transfer switch shall be UL listed and labeled.

1. CSA C22.2, No. 14 – M91 Industrial Control Equipment.

2. CSA 282, Emergency Electrical Power Supply for Buildings.

3. NFPA110 – Emergency and Standby Power Systems. The transfer switch shall meet all requirements for level 1 systems.

4. IEEE446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.

5. NEMA ICS10 – AC Automatic Transfer Switches.

D. The transfer switch manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

E. Transfer switch equipment specifications for this project are based on microprocessor-based transfer switches. The transfer switch shall be CUMMINS POWER GENERATION Model OTPC or an equal as manufactured by AUTOMATIC SWITCH COMPANY (ASCO) Model 7000 Series.

F. Ratings

1. The transfer switch shall be three pole, four wire, 277/480 volt, 60 hertz, 150 amp.

2. Main contacts shall be rated for 600 Volts AC minimum.

3. Transfer switch(es) shall be rated to carry 100 percent of rated current continuously in the enclosure supplied, in ambient temperatures of - 40 to + 60 degrees C, relative humidity up to 95% (non-condensing), and altitudes up to 10,000 feet (3000M).

4. Transfer switch equipment shall have a minimum withstand and closing ratings (WCR) in RMS symmetrical amperes of 30,000. The transfer switch and its upstream protection shall be third party listed and labeled for use with the specific protective device(s) installed in the application.

G. Construction

1. Transfer switch(es) shall be double-throw, electrically and mechanically interlocked, and mechanically held in the source 1 and source 2 positions. The transfer switch shall be specifically designed to transfer to the best available source if it inadvertently stops in a neutral position.

2. Transfer switches shall be equipped with permanently attached manual operating handles and quick-break, quick-make over-center contact mechanisms.

3. Main switch contacts shall be high-pressure silver alloy. Contact assemblies shall have arc chutes for positive arc extinguishing. Arc chutes shall have insulating covers to prevent inter-phase flashover.

4. Transfer switch internal wiring shall be composed of pre-manufactured harnesses that are permanently marked for source and destination. Harnesses shall be connected to the control system by means of locking disconnect plug(s), to allow the control system to be easily disconnected and serviced without disconnecting power from the transfer switch mechanism.

5. Transfer switch shall be provided with flame retardant transparent covers to allow viewing of switch contact operation but prevent direct contact with line voltage components.

6. Transfer switches shall be provided with a neutral bus and lugs. The neutral bus shall be sized to carry 100% of the current designed on the switch rating.

H. Connections

1. Field control connections shall be made on a common terminal block that is clearly and permanently labeled.

2. Transfer switch shall be provided with AL/CU mechanical lugs sized to accept the full output rating of the generator set.

I. Transfer Switch Control

1. Operator Panel. Each transfer switch shall be provided with a control panel to allow the operator to view the status and control operation of the transfer switch. The operator panel shall be a sealed membrane panel rated NEMA 3R/IP53 or better (regardless of enclosure rating) that is permanently labeled for switch and control functions. The operator panel shall be provided with the following features and capabilities.

a) High intensity LED lamps to indicate the source that the load is connected to (source 1 or source 2); and which source(s) are available. Source available LED indicators shall operate from the control microprocessor to indicate the true condition of the sources as sensed by the control.

b) High intensity LED lamps to indicate that the transfer switch is “not in auto” (due to control being disabled or due to bypass switch enabled or in operation) and “Test/Exercise Active” to indicate that the control system is testing or exercising the generator set.

c) “OVERRIDE” pushbutton to cause the transfer switch to bypass any active time delays for start, transfer, and retransfer and immediately proceed with its next logical operation.

d) “TEST” pushbutton to initiate a preprogrammed test sequence for the generator set and transfer switch. The transfer switch shall be programmable for test with load or test without load.

e) “RESET/LAMP TEST” pushbutton that will clear any faults present in the control, or simultaneously test all lamps on the panel by lighting them.

f) The control system shall continuously log information on the number of hours each source has been connected to the load, the number of times transferred, and the total number of times each source has failed. This information shall be available via the service tool or an operator

display panel.

g) Vacuum fluorescent alphanumeric display panel with push-button navigation switches. The display shall be clearly visible in both bright (sunlight) and no light conditions. It shall be visible over an angle of at least 120 degrees. The Alphanumeric display panel shall be capable of providing the following functions and capabilities.

(1) Display source condition information, including AC voltage for each phase of normal and emergency source, frequency of each source. Voltage for all three phases shall be displayed on a single screen for easy viewing of voltage balance.

(2) Display source status, to indicate source is connected or not connected.

(3) Display load data, including 3-phase AC voltage, 3-phase AC current, frequency, KW, KVA, and power factor. Voltage and current data for all phases shall be displayed on a single screen.

(4) The display panel shall allow the operator to view and make the following adjustments in the control system, after entering an access code:

(a) Set nominal voltage and frequency for the transfer switch.

(b) Adjust voltage and frequency sensor operation set points.

(c) Set up time clock functions.

(d) Set up load sequence functions.

(e) Enable or disable control functions in the transfer switch, including program transition.

(f) Set up exercise and load test operation conditions, as well as normal system time delays for transfer time, time delay start, stop, transfer, and retransfer.

(5) Display Real Time Clock data, including date, and time in hours, minutes, and seconds. The real-time clock shall

incorporate provisions for automatic daylight savings time and leap year adjustments. The control shall also log total operating hours for the control system.

(6) Display service history for the transfer switch. Display source connected hours, to indicate the total number of hours connected to each source. Display number of times transferred, and total number of times each source has failed.

(7) Display fault history on the transfer switch, including condition, and date and time of fault. Faults to include controller checksum error, low controller DC Voltage, ATS fail to close on transfer, ATS fail to close on retransfer, battery charger malfunction, network battery voltage low, network communications error.

(8) Display information for other transfer switches in the system, including transfer switch name, real time load in KW on the transfer switch, current source condition, and current operating mode.

J. Internal Controls

1. The transfer switch control system shall be configurable in the field for any operating voltage level up to 600VAC. Provide RMS voltage sensing and metering that is accurate to within plus or minus 1% of nominal voltage level. Frequency sensing shall be accurate to within plus or minus 0.2%. Voltage sensing shall be monitored based on the normal voltage at the site. Systems that utilize voltage monitoring based on standard voltage conditions are not acceptable.

2. Transfer switch voltage sensors shall be close differential type, providing source availability information to the control system based on the following functions:

a) Monitoring all phases of the normal service (source 1) for under voltage conditions (adjustable for pickup in a range of 85 to 98% of the normal voltage level and dropout in a range of 75 to 98% of normal voltage level).

b) Monitoring all phases of the emergency service (source 2) for under voltage conditions (adjustable for pickup in a range of 85 to 98% of the normal voltage level and dropout in a range of 75 to 98% of pickup voltage level).

c) Monitoring all phases of the normal service (source 1) and emergency service (source 2) for voltage imbalance.

d) Monitoring all phases of the normal service (source 1) and emergency service (source 2) for loss of a single phase.

e) Monitoring all phases of the normal service (source 1) and emergency service (source 2) for phase rotation.

f) Monitoring all phases of the normal service (source 1) and emergency service (source 2) for over voltage conditions (adjustable for dropout over a range of 105 to 135% of normal voltage, and pickup at 95-99% of dropout voltage level).

g) Monitoring all phases of the normal service (source 1) and emergency service (source 2) for over or under frequency conditions.

h) Monitoring the neutral current flow in the load side of the transfer switch. The control shall initiate an alarm when the neutral current exceeds a preset adjustable value in the range of 100-150% of rated phase current for more than an adjustable time period of 10 to 60 seconds.

3. All transfer switch sensing shall be configurable from a Windows XP or NT PC-based service tool, to allow setting of levels, and enabling or disabling of features and functions. Selected functions including voltage sensing levels and time delays shall be configurable using the operator panel. The transfer control shall incorporate a series of diagnostic LED lamps.

4. The transfer switch shall be configurable to control the operation time from source to source (program transition operation). The control system shall be capable of enabling or disabling this feature, and adjusting the time period to a specific value. A phase band monitor or similar device is not an acceptable alternate for this feature.

5. The transfer switch shall incorporate adjustable time delays for generator set start (adjustable in a range from 0-15 seconds); transfer (adjustable in a range from 0-120 seconds); retransfer (adjustable in a range from 0- 30 minutes); and generator stop (cooldown) (adjustable in a range of 0- 30 minutes).

6. The control system shall be designed and prototype tested for operation in ambient temperatures from – 20°C to + 60°C.

7. The control shall have optically isolated logic inputs, high isolation transformers

for AC inputs, and relays on all outputs, to provide optimum protection from line voltage surges, RFI and EMI.

8. The transfer switch shall be provided with a battery charger for the generator set starting batteries. The battery charger shall be a float type charger rated 10 amps. The battery charger shall include an ammeter for display of charging current and shall have fused AC inputs and DC outputs. The charger shall also include fault indications for high and low DC voltage and supply power failed, and dry contacts for external indication of these fault conditions. Supply power failed indication shall be displayed on the ATS control panel.

K. Control Interface

1. The transfer switch will provide an isolated relay contact for starting of a generator set. The relay shall be normally held open, and close to start the generator set. Output contacts shall be form C, for compatibility with any generator set.

2. Provide one set of Form C auxiliary contacts on both sides, operated by transfer switch position, rated 10 amps 250 VAC.

L. Enclosure

1. Enclosures shall be UL listed, NEMA Type 1. The enclosure shall provide NEC wire bend space. The cabinet door shall be key-locking.

M. Operation

1. Transfer switch normally connects an energized utility power source (source1) to loads and a generator set (source 2) to the loads when normal source fails. The normal position of the transfer switch is source 1 (connected to the utility), and no start signal is supplied to the genset.

2. Generator Set Exercise (Test) With Load Mode. The control system shall be configurable to test the generator set under load. In this mode, the transfer switch shall control the generator set in the following sequence:

a) Transfer switch shall initiate the exercise sequence at a time indicated in the exercise timer program, or when manually initiated by the operator.

b) When the control systems senses the generator set at rated voltage and frequency, it shall operate to connect the loads to the generator set by opening the normal source contacts, and closing the alternate

source contacts a predetermined time period later. The timing sequence for the contact operation shall be programmable in the controller.

c) The generator set shall operate connected to the load for the duration of the exercise period. If the generator set fails during this period, the transfer switch shall automatically reconnect the generator set to the normal service.

d) On completion of the exercise period, the transfer switch shall operate to connect the loads to the normal source by opening the alternate source contacts, and closing the normal source contacts a predetermined time period later. The timing sequence for the contact operation shall be programmable in the controller.

e) The transfer switch shall operate the generator set unloaded for a cooldown period, and then remove the start signal from the generator set. If the normal power fails at any time when the generator set is running, the transfer switch shall immediately connect the system loads to the generator set.

3. Generator Set Exercise (Test) Without Load Mode. The control system shall be configurable to test the generator set without transfer switch load connected. In this mode, the transfer switch shall control the generator set in the following sequence:

a) Transfer switch shall initiate the exercise sequence at a time indicated in the exercise timer program, or when manually initiated by the operator.

b) When the control systems senses the generator set at rated voltage and frequency, it shall operate the generator set unloaded for the duration of the exercise period.

c) At the completion of the exercise period, the transfer switch shall remove the start signal from the generator set. If the normal power fails at any time when the generator set is running, the transfer switch shall immediately connect the system loads to the generator set.

Part 3 - Execution

I. INSTALLATION

A. This Contractor shall furnish and install complete the standby electrical power system including the engine generator set, automatic transfer switch, batteries, exhaust system, vibration isolation, cooling system, electrical system, concrete pad, and accessories in

accordance with the system manufacturer's recommendations.

B. The Contractor shall furnish and install a six (6) inch high by six (6) inch greater all sides concrete base foundation for the engine generator set.

1. Concrete foundation shall be as follows:

a) Minimum compressive strength at 28 days – 3500 PSI
b) Maximum nominal aggregate size – 1 inch
c) Maximum W/C ratio by mass – 0.45
d) Air content – 5 ± 1%
e) Slump – 2" ± 0.75"

2. Top of concrete bases shall be trowel finished smooth and level with beveled edges. Top surface shall not vary by more than 1/8" in depth as measured across the widest surface.

3. All concrete shall be fully vibrated.

4. Reinforcing Steel – Reinforcing to meet ASTM requirements. Spacing of bars shall be adjusted to suit conduit spacing.

C. This Contractor shall ground the generator set as per the NEC, as shown on the Drawings, and as herein specified.

D. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired. Equipment shall be thoroughly cleaned to remove all dirt and debris.

II. START-UP SERVICE AND ACCEPTANCE TEST

A. Start-up Service: The standby electrical power system's equipment shall be initially started, operated and tested by the manufacturer's representative prior to the "on-site acceptance test".

B. On-Site Acceptance Test: The manufacturer shall furnish service personnel and all testing equipment and temporary cable connections to completely service and field test, in the presence of the Owner, the standby electrical power system. The test shall include, but not be limited to, a "cold start" test, a minimum period of four (4) hours with a load bank at one hundred percent (100%) of the nameplate rating of the engine generator set and a one-step rated load pick-up test in accordance with NFPA 110. The manufacturer shall make any adjustments to the system to assure proper operation. The manufacturer shall then instruct the Owner's personnel as to proper maintenance and operation and furnish three (3) sets of operating, technical, factory service manuals

and maintenance instructions, including descriptive literature of equipment, parts list, and the names and telephone numbers of manufacturer's representatives.

III. WARRANTY

A. The warranty for the complete standby electric power system shall be unconditional for a period of one (1) year with unlimited operating hours from the date of the successful acceptance test. The warranty shall be furnished by the system manufacturer. Said coverage shall be for all equipment provided under this specification section whether or not it is manufactured by the Standby Electrical System Manufacturer and shall include parts, labor, travel expenses, and labor to remove/reinstall said equipment per the manufacturer's standard published warranty. There shall be no deductibles applied to said warranty. Multiple warranties for individual components, engine alternator, controls, etc. will not be acceptable. Satisfactory warranty documents shall be furnished. Refer to SECTION 01740 WARRANTIES AND BONDS.

B. Contractor shall provide Warranty Coverage Labels mounted conspicuously on the engine generator control section and on the door of the automatic load transfer switch. The labels shall identify the one source supplier/manufacturer's address and telephone number, coverage description, coverage type, start-up date, model number, serial number, system registration number and other information deemed pertinent by the supplier/manufacturer. It is the intent of this warranty specification to have a single source contact for the Owner to call for warranty service for all standby electrical power system equipment.

C. The manufacturer shall be prepared to offer a service contract for the maintenance of the standby electric power system after the warranty period and/or an extended warranty.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include furnishing and installing the standby electrical power system consisting of an emergency engine generator set and automatic transfer switch as shown on the Drawings and herein specified.

B. The existing standby electrical power system shall remain in operation and shall continue to serve the building's emergency power during the construction period until the new system has been installed and tested, ready for operation. After the new system has assumed the building's entire emergency power load, the existing system shall be removed as shown on the Drawings.

III. SUBMITTALS

A. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:

1. Thermal damage curve for generator.

2. Time-current characteristic curves for generator protective device.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.

2. Wiring Diagrams: Power, signal, and control wiring.

C. Qualification Data: Manufacturer shall demonstrate they manufacture either the alternator or the generator. Manufacturers that assemble, and do not manufacture the alternator or the generator shall not be permitted.

D. Source quality-control test reports.

1. Certified summary of prototype-unit test report.

2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.

3. Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria for sensitive loads.

4. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.

5. Report of sound generation.

6. Report of exhaust emissions showing compliance with applicable regulations.

7. Certified Torsional Vibration Compatibility: Comply with NFPA 110.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals.

G. Warranty: Special warranty specified in this Section.

IV. QUALITY ASSURANCE

A. All applicable parts of the standby electrical power system shall meet National Electrical Manufacturer's Association (NEMA) and National Fire Protection Association (NFPA) standards, and be Underwriter's Laboratories, Inc. (UL) listed to UL 2200. The system shall be installed to meet the requirements of the National Electric Code (NEC) and all applicable state and local codes, and these Specifications.

B. This system shall be completely built, tested, and shipped by a manufacturer who has been regularly engaged in the production of such equipment for the past ten (10) years and who has had parts and service facilities available locally (within a 50-mile radius of the job site) for the past five (5) years.

C. The supplier of the standby electrical power system shall have and shall be able to demonstrate fully stocked service vehicles. The supplier shall also have factory trained and factory certified maintenance technicians on staff.

D. The performance of the standby electrical power system shall be certified by an independent testing laboratory as to the unit's full power rating, voltage, and frequency regulation.

E. The standby electrical power system shall provide standby for the emergency white and exit lights and other such auxiliary power as indicated on the Drawings so as to operate automatically in the event of an utility power failure of the "normal" power system.

F. Submittals are required in accordance with SECTION 16010 of the Specifications. The manufacturer shall furnish printed literature and brochures describing the standard

series specified (not a one of a kind fabrication). The manufacturer shall furnish schematic and wiring diagrams for the engine generator set and automatic load transfer switch; and an interconnecting diagram showing connections to individual components which constitute the standby electrical power system.

G. The performance tests of the generating set series shall be in accordance with procedures certified by an independent testing laboratory. The manufacturer shall have successfully tested a prototype of the generating set series offered which shall include: maximum power level; maximum motor starting capacity; structural soundness; torsigraph analysis; fuel consumption; engine-alternator cooling air flow; transient response and steady state governing; alternator temperature rise per NEMA MG1-22.40; single step load pickup per NFPA 76A- 822; harmonic analysis and voltage waveform deviation; and three-phase short circuit test for mechanical and electrical strength.

H. The generator set manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

I. The manufacturer shall maintain model and serial number records for each engine generator set and automatic load transfer switch provided for at least 20 years.

J. Manufacturer Qualifications: The manufacturer of the gen set shall be either a manufacturer of the engine or the alternator. Maintain, within 200 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

K. The generator set manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

L. The manufacturer shall maintain model and serial number records for each engine generator set and automatic load transfer switch provided for at least 20 years.

M. Source Limitations: Obtain packaged generator set, automatic transfer switches and auxiliary components through one source from a single manufacturer.

V. COORDINATION

A. Coordinate size and location of concrete bases for package engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

VI. MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of manufacturer's designated service organization.

B. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

Part 2 - Products

I. DESCRIPTION

A. The standby electrical power system shall be furnished and installed by this Contractor as shown on the Drawings and as herein specified. The system shall be manufactured by CUMMINS POWER GENERATION as listed herein or equal as manufactured by CATERPILLAR (OLYMPIAN) GENERAC POWER SYSTEMS, or KOHLER POWER SYSTEMS.

B. The standby electrical power system shall be an electric plant rated for continuous standby service at 45 KW, 0.8 power factor, 277/480 volts, three phase, four wire, 60 Hertz. A standby electrical power system that will meet this specification is CUMMINS POWER GENERATION Model Number 45 GGPC. The system shall be a package of new and current equipment consisting of:

1. A natural gas fueled engine generator set, as indicated on the Drawings, to provide standby electrical power.
2. An automatic transfer switch to provide automatic starting and stopping of the engine generator set and switching of the load.
3. Mounted accessories as herein specified.
4. Three pole, 90 amp output main circuit breaker. Provide auxiliary contacts to indicate circuit breaker status.
5. Engine mounted start-stop control system.
6. Spring type vibration isolators.
7. Remote annunciator panel.

II. ENGINE GENERATOR SET

A. Engine

1. The engine shall be natural gas fueled, four (4) cycle, water cooled, with natural aspiration, mounted radiator, fan, and water pump. It shall have six (6) cylinders with a minimum displacement of 305 cubic inches, with a minimum rating of 77.3-brake horsepower at operating speed of 1800 RPM. Free-turn overhead valves shall be alloy steel with hard chrome-cobalt alloy. Full pressure lubrication shall be supplied by a gear oil pump. The engine shall have a replaceable, full-flow oil filter and gaseous fuel pressure regulation and solenoid valve. Engine speed shall be governed by an electronic governor for isochronous frequency regulation. The engine shall have a twelve (12) volt, DC, battery charging alternator (70A) automatically controlled by a solid-state voltage regulator. Starting shall be by a twelve (12) volt electric starter.

2. The complete engine shall be furnished with a start control that operates on contact closing and a stop control that operates on contact opening. A cranking limiter shall be provided to open the starting circuit in approximately forty-five (45) seconds if the plant is not started within that time.

B. The alternator shall be a four (4) pole revolving field type with static exciter and torque matched voltage regulator. No commutator or commutator brushes shall be allowed. The starter shall be directly connected to the engine flywheel housing, and the rotor shall be driven through a rigid coupling to insure permanent alignment. Voltage regulation shall be within plus or minus two percent (2%) of rated voltage, from no-load to full-load. The instantaneous voltage dip shall be less than twelve percent (12%) of rated voltage when full- load and rated power factor is applied to the alternator. Recovery to stable operation shall occur within two (2) seconds. Stable or steady-state operation is defined as operation with terminal voltage remaining constant within plus or minus one (1%) percent of rated voltage. Temperature rise shall not be more than one hundred twenty-five (125) degrees F over forty (40) degrees ambient at rated load. A permanent magnet generator shall provide excitation power to the automatic voltage regulator for immunity from voltage distortion caused by non- linear SCR controlled loads on the unit. The permanent magnet generator shall sustain short circuit current for selective operation and coordination of overcurrent devices.

C. The engine generator set control panel shall be wired, tested, and shock mounted on the generator set by the manufacturer of the alternator. It shall contain: panel lighting; RUN-STOP-REMOTE selector switch; coolant temperature gauge; field circuit breaker; DC voltmeter; running time meter; lamp test switch; oil pressure gauge; fault reset switch; cycle cranking; and low coolant level shutdown. The panel shall contain a twelve (12) light monitor panel with the following: green RUN light; yellow PREWARNING FOR LOW OIL PRESSURE light; yellow PREWARNING FOR HIGH COOLANT TEMPERATURE light; red LOW OIL PRESSURE SHUTDOWN light; red HIGH COOLANT TEMPERATURE SHUTDOWN light; red OVERCRANK SHUTDOWN light; red OVERSPEED SHUTDOWN light; flashing red SWITCH OFF light; yellow LOW COOLANT TEMPERATURE light; yellow.

D. The engine generating set shall be mounted on a welded steel base which shall provide for suitable mounting by this Contractor to any level surface. This Contractor shall furnish and install vibration isolators of the number and size required for the total weight of the unit between the steel base and mounting pad.

E. Accessories required for the proper operation of the engine generator set shall be furnished by the manufacturer. These shall include, but not be limited to, the following:

1. Flexible exhaust connectors.

2. Twelve (12) volt lead acid type starting batteries.

3. Battery rack and cables.

4. Additional solenoid valve (shipped loose).

5. This Contractor shall install the additional DC voltage solenoid valve supplied, prior to the flexible fuel line and wire as directed by the engine generator

manufacturer to the control circuit to open with the engine operation.

6. Flexible gas lines.

7. Gaseous fuel pressure regulator (to be supplied by the Division 15 Contractor).

8. Single phase, 1.5 kW, 120 volt crank case heater, direct connected. Plug and cord connected type will not be acceptable.

9. Fifty percent (50%) ethylene glycol antifreeze solution to fill engine cooling system.

10. Two (2) 12-volt Form C dry contacts for connection to the fire alarm system graphic annunciator panel for “Generator Run” and “Generator Fault” indications.

11. Two (2) 12-volt Form C dry contacts for connection to the security intrusion system panel for “Generator Run” and “Generator Fault” indications.

F. The engine generator set shall be enclosed with a weather protective housing. The housing shall be rated for sound attenuation of sixty-three (63) dB(A) average at seven (7) meters when using an eight (8) position measurement system using tests conducted per ANSI S1.13-1971. Acoustical materials shall be oil and water-resistant. A critical silencer muffler shall be mounted inside the housing with raincap and rainshield. The housing shall be attached to the skid base of the generator set and constructed of minimum 14-gauge metal using non-marring fasteners. The access doors shall have both key-lockable door handles and provisions for padlocking and mounted using stainless steel hinges. Paint protection shall be epoxy primer and dual coat electrodeposition method for all sides and all metal surfaces. Overspray of hoses, clamps, wiring and harnesses, and other serviceable items shall not be acceptable.

III. AUTOMATIC TRANSFER SWITCH

A. The complete automatic transfer switch shall be suitable for utility power (source 1) to engine generator set (source 2) application, be completely factory assembled with digital electronic controls designed for surge voltage isolation, and including voltage sensors on all phases of both sources, linear operator, permanently attached manual handles, positive mechanical and electrical interlocking, and mechanically held contacts.

B. The automatic transfer switch shall conform to the requirements of the following codes and standards (latest editions):

1. UL1008. The transfer switch shall be UL listed and labeled.

2. CSA C22.2, No. 14 – M91 Industrial Control Equipment.

3. CSA 282, Emergency Electrical Power Supply for Buildings.

4. NFPA110 – Emergency and Standby Power Systems. The transfer switch shall

meet all requirements for level 1 systems.

5. IEEE446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.

6. NEMA ICS10 – AC Automatic Transfer Switches.

C. The transfer switch manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

D. Transfer switch equipment specifications for this project are based on microprocessor-based transfer switches. The transfer switch shall be CUMMINS POWER GENERATION Model OTPC or equal as manufactured by AUTOMATIC SWITCH COMPANY (ASCO) Model 7000 Series.

E. Ratings

1. The transfer switch shall be three pole, four wire, 277/480 volt, 60 hertz, 150 amp.

2. Main contacts shall be rated for 600 Volts AC minimum.

3. Transfer switch(es) shall be rated to carry 100 percent of rated current continuously in the enclosure supplied, in ambient temperatures of - 40 to + 60 degrees C, relative humidity up to 95% (non-condensing), and altitudes up to 10,000 feet (3000M).

4. Transfer switch equipment shall have a minimum withstand and closing ratings (WCR) in RMS symmetrical amperes of 30,000. The transfer switch and its upstream protection shall be third party listed and labeled for use with the specific protective device(s) installed in the application.

F. Construction

1. Transfer switch(es) shall be double-throw, electrically and mechanically interlocked, and mechanically held in the source 1 and source 2 positions. The transfer switch shall be specifically designed to transfer to the best available source if it inadvertently stops in a neutral position.

2. Transfer switches shall be equipped with permanently attached manual operating handles and quick-break, quick-make over-center contact mechanisms.

3. Main switch contacts shall be high-pressure silver alloy. Contact assemblies shall have arc chutes for positive arc extinguishing. Arc chutes shall have insulating covers to prevent inter-phase flashover.

4. Transfer switch internal wiring shall be composed of pre-manufactured

harnesses that are permanently marked for source and destination. Harnesses shall be connected to the control system by means of locking disconnect plug(s), to allow the control system to be easily disconnected and serviced without disconnecting power from the transfer switch mechanism.

5. Transfer switch shall be provided with flame retardant transparent covers to allow viewing of switch contact operation but prevent direct contact with line voltage components.

6. Transfer switches shall be provided with a neutral bus and lugs. The neutral bus shall be sized to carry 100% of the current designed on the switch rating.

G. Connections

1. Field control connections shall be made on a common terminal block that is clearly and permanently labeled.

2. Transfer switch shall be provided with AL/CU mechanical lugs sized to accept the full output rating of the generator set.

H. Transfer Switch Control

1. Operator Panel. Each transfer switch shall be provided with a control panel to allow the operator to view the status and control operation of the transfer switch. The operator panel shall be a sealed membrane panel rated NEMA 3R/IP53 or better (regardless of enclosure rating) that is permanently labeled for switch and control functions. The operator panel shall be provided with the following features and capabilities.

a) High intensity LED lamps to indicate the source that the load is connected to (source 1 or source 2); and which source(s) are available. Source available LED indicators shall operate from the control microprocessor to indicate the true condition of the sources as sensed by the control.

b) High intensity LED lamps to indicate that the transfer switch is “not in auto” (due to control being disabled or due to bypass switch enabled or in operation) and “Test/Exercise Active” to indicate that the control system is testing or exercising the generator set.

c) “OVERRIDE” pushbutton to cause the transfer switch to bypass any active time delays for start, transfer, and retransfer and immediately proceed with its next logical operation.

d) “TEST” pushbutton to initiate a preprogrammed test sequence for the generator set and transfer switch. The transfer switch shall be programmable for test with load or test without load.

e) “RESET/LAMP TEST” pushbutton that will clear any faults present in the control, or simultaneously test all lamps on the panel by lighting

them.

f) The control system shall continuously log information on the number of hours each source has been connected to the load, the number of times transferred, and the total number of times each source has failed. This information shall be available via the service tool or an operator display panel.

g) Vacuum fluorescent alphanumeric display panel with push-button navigation switches. The display shall be clearly visible in both bright (sunlight) and no light conditions. It shall be visible over an angle of at least 120 degrees. The Alphanumeric display panel shall be capable of providing the following functions and capabilities.

(1) Display source condition information, including AC voltage for each phase of normal and emergency source, frequency of each source. Voltage for all three phases shall be displayed on a single screen for easy viewing of voltage balance.

(2) Display source status, to indicate source is connected or not connected.

(3) Display load data, including 3-phase AC voltage, 3-phase AC current, frequency, KW, KVA, and power factor. Voltage and current data for all phases shall be displayed on a single screen.

(4) The display panel shall allow the operator to view and make the following adjustments in the control system, after entering an access code:

(a) Set nominal voltage and frequency for the transfer switch.

(b) Adjust voltage and frequency sensor operation set points.

(c) Set up time clock functions.

(d) Set up load sequence functions.

(e) Enable or disable control functions in the transfer switch, including program transition.

(f) Set up exercise and load test operation conditions, as well as normal system time delays for transfer time, time delay start, stop, transfer, and retransfer.

(5) Display Real Time Clock data, including date, and time in hours, minutes, and seconds. The real-time clock shall

incorporate provisions for automatic daylight savings time and leap year adjustments. The control shall also log total operating hours for the control system.

(6) Display service history for the transfer switch. Display source connected hours, to indicate the total number of hours connected to each source. Display number of times transferred, and total number of times each source has failed.

(7) Display fault history on the transfer switch, including condition, and date and time of fault. Faults to include controller checksum error, low controller DC Voltage, ATS fail to close on transfer, ATS fail to close on retransfer, battery charger malfunction, network battery voltage low, network communications error.

(8) Display information for other transfer switches in the system, including transfer switch name, real time load in KW on the transfer switch, current source condition, and current operating mode.

I. Internal Controls

1. The transfer switch control system shall be configurable in the field for any operating voltage level up to 600VAC. Provide RMS voltage sensing and metering that is accurate to within plus or minus 1% of nominal voltage level. Frequency sensing shall be accurate to within plus or minus 0.2%. Voltage sensing shall be monitored based on the normal voltage at the site. Systems that utilize voltage monitoring based on standard voltage conditions are not acceptable.

2. Transfer switch voltage sensors shall be close differential type, providing source availability information to the control system based on the following functions:

a) Monitoring all phases of the normal service (source 1) for under voltage conditions (adjustable for pickup in a range of 85 to 98% of the normal voltage level and dropout in a range of 75 to 98% of normal voltage level).

b) Monitoring all phases of the emergency service (source 2) for under voltage conditions (adjustable for pickup in a range of 85 to 98% of the normal voltage level and dropout in a range of 75 to 98% of pickup voltage level).

c) Monitoring all phases of the normal service (source 1) and emergency service (source 2) for voltage imbalance.

d) Monitoring all phases of the normal service (source 1) and emergency service (source 2) for loss of a single phase.

e) Monitoring all phases of the normal service (source 1) and emergency service (source 2) for phase rotation.

f) Monitoring all phases of the normal service (source 1) and emergency service (source 2) for over voltage conditions (adjustable for dropout over a range of 105 to 135% of normal voltage, and pickup at 95-99% of dropout voltage level).

g) Monitoring all phases of the normal service (source 1) and emergency service (source 2) for over or under frequency conditions.

h) Monitoring the neutral current flow in the load side of the transfer switch. The control shall initiate an alarm when the neutral current exceeds a preset adjustable value in the range of 100-150% of rated phase current for more than an adjustable time period of 10 to 60 seconds.

3. All transfer switch sensing shall be configurable from a Windows XP or NT PC-based service tool, to allow setting of levels, and enabling or disabling of features and functions. Selected functions including voltage sensing levels and time delays shall be configurable using the operator panel. The transfer control shall incorporate a series of diagnostic LED lamps.

4. The transfer switch shall be configurable to control the operation time from source to source (program transition operation). The control system shall be capable of enabling or disabling this feature, and adjusting the time period to a specific value. A phase band monitor or similar device is not an acceptable alternate for this feature.

5. The transfer switch shall incorporate adjustable time delays for generator set start (adjustable in a range from 0-15 seconds); transfer (adjustable in a range from 0-120 seconds); retransfer (adjustable in a range from 0-30 minutes); and generator stop (cooldown) (adjustable in a range of 0-30 minutes).

6. The control system shall be designed and prototype tested for operation in ambient temperatures from – 20°C to + 60°C.

7. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs, and relays on all outputs, to provide optimum protection from line voltage surges, RFI and EMI.

8. The transfer switch shall be provided with a battery charger for the generator set starting batteries. The battery charger shall be a float type charger rated 10 amps. The battery charger shall include an ammeter for display of charging current and shall have fused AC inputs and DC outputs. The charger shall also include fault indications for high and low DC voltage and supply power failed, and dry contacts for external indication of these fault conditions. Supply power failed indication shall be displayed on the ATS control panel.

J. Control Interface

1. The transfer switch will provide an isolated relay contact for starting of a generator set. The relay shall be normally held open, and close to start the generator set. Output contacts shall be form C, for compatibility with any generator set.

2. Provide one set of Form C auxiliary contacts on both sides, operated by transfer switch position, rated 10 amps 250 VAC.

K. Enclosure

1. Enclosures shall be UL listed, NEMA Type 1. The enclosure shall provide NEC wire bend space. The cabinet door shall be key-locking.

L. Operation

1. Transfer switch normally connects an energized utility power source (source1) to loads and a generator set (source 2) to the loads when normal source fails. The normal position of the transfer switch is source 1 (connected to the utility), and no start signal is supplied to the genset.

2. Generator Set Exercise (Test) With Load Mode. The control system shall be configurable to test the generator set under load. In this mode, the transfer switch shall control the generator set in the following sequence:

a) Transfer switch shall initiate the exercise sequence at a time indicated in the exercise timer program, or when manually initiated by the operator.

b) When the control systems senses the generator set at rated voltage and frequency, it shall operate to connect the loads to the generator set by opening the normal source contacts, and closing the alternate source contacts a predetermined time period later. The timing sequence for the contact operation shall be programmable in the controller.

c) The generator set shall operate connected to the load for the duration of the exercise period. If the generator set fails during this period, the transfer switch shall automatically reconnect the generator set to the normal service.

d) On completion of the exercise period, the transfer switch shall operate to connect the loads to the normal source by opening the alternate source contacts, and closing the normal source contacts a predetermined time period later. The timing sequence for the contact operation shall be programmable in the controller.

e) The transfer switch shall operate the generator set unloaded for a cool down period, and then remove the start signal from the generator set. If the normal power fails at any time when the generator set is running,

the transfer switch shall immediately connect the system loads to the generator set.

3. Generator Set Exercise (Test) Without Load Mode. The control system shall be configurable to test the generator set without transfer switch load connected. In this mode, the transfer switch shall control the generator set in the following sequence:

   a) Transfer switch shall initiate the exercise sequence at a time indicated in the exercise timer program, or when manually initiated by the operator.

   b) When the control systems senses the generator set at rated voltage and frequency, it shall operate the generator set unloaded for the duration of the exercise period.

   c) At the completion of the exercise period, the transfer switch shall remove the start signal from the generator set. If the normal power fails at any time when the generator set is running, the transfer switch shall immediately connect the system loads to the generator set.

IV. REMOTE ALARM ANNUNCIATOR PANEL

A. Provide and install a 20-light LED type remote alarm annunciator with horn, located as shown on the drawings in the building engineer's office. The remote annunciator shall provide all the audible and visual alarms called for by NFPA Standard 110 for level 1 systems for the local generator control panel. Spare lamps shall be provided to allow future addition of other alarm and status functions to the annunciator. Provisions for labeling of the annunciator in a fashion consistent with the specified functions shall be provided. Alarm silence and lamp test switch(es) shall be provided. LED lamps shall be replaceable, and indicating lamp color shall be capable of changes needed for specific application requirements. Alarm horn shall be switchable for all annunciation points. Alarm horn (when switched on) shall sound for first fault, and all subsequent faults, regardless of whether first fault has been cleared, in compliance with NFPA110 3-5.6.2. The interconnecting wiring between the annunciator and other system components shall be monitored and failure of the interconnection between components shall be displayed on the annunciator panel.

B. The annunciator shall include the following alarm labels, audible annunciation features, and lamp colors:

Condition	Lamp Color	Audible Alarm
Normal Power (to Loads)	Green	No
Genset Supplying Load	Amber	No
Genset Running	Green	No
Not in Auto	Red (Flashing)	Yes
High Battery Voltage	Red	Yes
Low Battery Voltage	Red	Yes
Charger AC Failure	Red	Yes
Fail to Start	Red	Yes

Low Engine Temperature	Amber	Yes
Pre-High Engine Temperature	Amber	Yes
High Engine Temperature	Red	Yes
Pre-Low Oil Pressure	Amber	Yes
Low Oil Pressure	Red	Yes
Overspeed	Red	Yes
Low Coolant Level	Amber	Yes
Low Fuel Pressure	Amber	Yes
Network OK	Green	Yes
(3) Spares	Configurable	Configurable

Low battery voltage lamp shall also be lighted for low cranking voltage or weak battery alarm.

Part 3 - Execution

I. INSTALLATION

A. This Contractor shall furnish and install complete the standby electrical power system including the engine generator set, automatic transfer switch, batteries, exhaust system, vibration isolation, cooling system, electrical system, concrete pad, and accessories in accordance with the system manufacturer's recommendations.

B. The Contractor shall furnish and install a six (6) inch high by six (6) inch greater all sides concrete base foundation for the engine generator set.

1. Concrete foundation shall be as follows:

a) Minimum compressive strength at 28 days – 3500 PSI
b) Maximum nominal aggregate size – 1 inch
c) Maximum W/C ratio by mass – 0.45
d) Air content – 5 ± 1%
e. Slump – 2” ± 0.75”

2. Top of concrete bases shall be trowel finished smooth and level with beveled edges. Top surface shall not vary by more than 1/8” in depth as measured across the widest surface.

3. All concrete shall be fully vibrated.

4. Reinforcing Steel – Reinforcing to meet ASTM requirements. Spacing of bars shall be adjusted to suit conduit spacing.

C. This Contractor shall ground the generator set as per the NEC, as shown on the Drawings, and as herein specified.

D. All equipment shall be physically inspected for damage. Scratches and other installation

damage shall be repaired. Equipment shall be thoroughly cleaned to remove all dirt and debris.

II. START-UP SERVICE AND ACCEPTANCE TEST

A. Start-up Service: The standby electrical power system's equipment shall be initially started, operated and tested by the manufacturer's representative prior to the "on-site acceptance test".

B. On-Site Acceptance Test: The manufacturer shall furnish service personnel and all testing equipment and temporary cable connections to completely service and field test, in the presence of the Owner, the standby electrical power system. The test shall include, but not be limited to, a "cold start" test, a minimum period of four (4) hours with a load bank test at one hundred percent (100%) of the nameplate rating of the engine generator set and a one-step rated load pickup test in accordance with NFPA 110. The manufacturer shall make any adjustments to the system to assure proper operation. The manufacturer shall then instruct the Owner's personnel as to proper maintenance and operation and furnish three (3) sets of operating, technical, factory service manuals and maintenance instructions, including descriptive literature of equipment, parts list, and the names and telephone numbers of manufacturer's representatives.

III. WARRANTY

A. The warranty for the complete standby electric power system shall be unconditional for a period of one (1) year with unlimited operating hours from the date of the successful acceptance test. The warranty shall be furnished by the system manufacturer. Said coverage shall be for all equipment provided under this specification section whether or not it is manufactured by the Standby Electrical System Manufacturer and shall include parts, labor, travel expenses, and labor to remove/reinstall said equipment per the manufacturer's standard published warranty. There shall be no deductibles applied to said warranty. Multiple warranties for individual components, engine alternator, controls, etc. will not be acceptable. Satisfactory warranty documents shall be furnished. Refer to SECTION 01740 WARRANTIES AND BONDS.

B. Contractor shall provide Warranty Coverage Labels mounted conspicuously on the engine generator control section and on the door of the automatic load transfer switch. The labels shall identify the one source supplier/manufacturer's address and telephone number, coverage description, coverage type, start-up date, model number, serial number, system registration number and other information deemed pertinent by the supplier/manufacturer. It is the intent of this warranty specification to have a single source contact for the Owner to call for warranty service for all standby electrical power system equipment.

C. The manufacturer shall be prepared to offer a service contract for the maintenance of the standby electric power system after the warranty period and/or an extended warranty.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include furnishing and installing the standby electrical power system consisting of an emergency engine generator set and automatic transfer switch as shown on the Drawings and herein specified.

B. The existing standby electrical power system shall remain in operation and shall continue to serve the building's emergency power during the construction period until the new system has been installed and tested, ready for operation. After the new system has assumed the building's entire emergency power load, the existing system shall be removed as shown on the Drawings.

III. SUBMITTALS

A. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:

1. Thermal damage curve for generator.

2. Time-current characteristic curves for generator protective device.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.

2. Wiring Diagrams: Power, signal, and control wiring.

C. Qualification Data: Manufacturer shall demonstrate they manufacture either the alternator or the generator. Manufacturers that assemble, and do not manufacture the alternator or the generator shall not be permitted.

D. Source quality-control test reports.

1. Certified summary of prototype-unit test report.

2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.

    a) Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria for sensitive loads.

    b) Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.

    c) Report of sound generation.

    d) Report of exhaust emissions showing compliance with applicable regulations.

    e) Certified Torsional Vibration Compatibility: Comply with NFPA 110.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals.

G. Warranty: Special warranty specified in this Section.

IV. QUALITY ASSURANCE

A. All applicable parts of the standby electrical power system shall meet National Electrical Manufacturer's Association (NEMA) and National Fire Protection Association (NFPA) standards, and be Underwriter's Laboratories, Inc. (UL) listed to UL 2200 and bear the UL label. The system shall be installed to meet the requirements of the National Electric Code (NEC) and all applicable state and local codes, and these Specifications.

B. This system shall be completely built, tested, and shipped by a manufacturer who has been regularly engaged in the production of such equipment for the past ten (10) years and who has had parts and service facilities available locally (within a 50-mile radius of the job site) for the past five (5) years.

C. The supplier of the standby electrical power system shall have and shall be able to demonstrate fully stocked service vehicles. The supplier shall also have factory trained and factory certified maintenance technicians on staff.

D. The performance of the standby electrical power system shall be certified by an independent testing laboratory as to the unit's full power rating, voltage, and frequency regulation.

E. The standby electrical power system shall provide standby for the emergency white and exit lights and other such auxiliary power as indicated on the Drawings so as to operate automatically in the event of a utility power failure of the "normal" power system.

F. Submittals are required in accordance with SECTION 16010 of the Specifications. The

manufacturer shall furnish printed literature and brochures describing the standard series specified (not a one of a kind fabrication). The manufacturer shall furnish schematic and wiring diagrams for the engine generator set and automatic load transfer switch; and an interconnecting diagram showing connections to individual components which constitute the standby electrical power system.

G. The performance tests of the generating set series shall be in accordance with procedures certified by an independent testing laboratory. The manufacturer shall have successfully tested a prototype of the generating set series offered which shall include: maximum power level; maximum motor starting capacity; structural soundness; torsigraph analysis; fuel consumption; engine-alternator cooling air flow; transient response and steady state governing; alternator temperature rise per NEMA MG1-22.40; single step load pickup per NFPA 76A- 822; harmonic analysis and voltage waveform deviation; and three-phase short circuit test for mechanical and electrical strength.

H. The generator set manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

I. The manufacturer shall maintain model and serial number records for each engine generator set and automatic load transfer switch provided for at least 20 years.

J. Manufacturer Qualifications: The manufacturer of the gen set shall be either a manufacturer of the engine or the alternator. Maintain, within 200 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

K. The generator set manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

L. The manufacturer shall maintain model and serial number records for each engine generator set and automatic load transfer switch provided for at least 20 years.

M. Source Limitations: Obtain packaged generator set, automatic transfer switches and auxiliary components through one source from a single manufacturer.

V. COORDINATION

A. Coordinate size and location of concrete bases for package engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

VI. MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of manufacturer's designated service organization.

B. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and

adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

Part 2 - Products

I. DESCRIPTION

A. The standby electrical power system shall be furnished and installed by this Contractor as shown on the Drawings and as herein specified. The system shall be manufactured by CUMMINS POWER GENERATION as listed herein or equal as manufactured by CATERPILLAR (OLYMPIAN), GENERAC POWER SYSTEMS, or KOHLER POWER SYSTEMS.

B. The standby electrical power system shall be an electric plant rated for continuous standby service at 100 KW, 0.8 power factor, 277/480 volts, three phase, four wire, 60 Hertz. A standby electrical power system that will meet this specification is CUMMINS POWER GENERATION Model Number 100 GGHH. The system shall be a package of new and current equipment consisting of:

1. A natural gas fueled engine generator set, as indicated on the Drawings, to provide standby electrical power.

2. An automatic transfer switch to provide automatic starting and stopping of the engine generator set and switching of the load.

3. Mounted accessories as herein specified.

4. Three pole, 200 amp output main circuit breaker. Provide auxiliary contacts to indicate circuit breaker status.

5. Engine mounted start-stop control system.

6. Spring type vibration isolators.

7. Remote annunciator panel.

II. ENGINE GENERATOR SET

A. Engine

1. The engine shall be natural gas fueled, four (4) cycle, water cooled, turbo charged with mounted radiator, fan, and water pump. It shall have eight (8) cylinders with a minimum displacement of 412.5 cubic inches, with a minimum rating of 176.0-brake horsepower at operating speed of 1800 RPM. Free-turn overhead valves shall be alloy steel with hard chrome-cobalt alloy. Full pressure lubrication shall be supplied by a gear oil pump. The engine shall have a replaceable, full-flow oil filter and gaseous fuel pressure regulation and solenoid

valve. Engine speed shall be governed by an electronic governor for isochronous frequency regulation. The engine shall have a twelve (12) volt, DC, battery charging alternator (65A) automatically controlled by a solid-state voltage regulator. Starting shall be by a twelve (12) volt electric starter.

2. The complete engine shall be furnished with a start control that operates on contact closing and a stop control that operates on contact opening. A cranking limiter shall be provided to open the starting circuit in approximately forty-five (45) seconds if the plant is not started within that time.

B. The alternator shall be a four (4) pole revolving field type with permanent magnet exciter and torque matched voltage regulator. No commutator or commutator brushes shall be allowed. The starter shall be directly connected to the engine flywheel housing, and the rotor shall be driven through a rigid coupling to insure permanent alignment. Voltage regulation shall be within plus or minus two percent (2%) of rated voltage, from no-load to full-load. The instantaneous voltage dip shall be less than twelve percent (12%) of rated voltage when full- load and rated power factor is applied to the alternator. Recovery to stable operation shall occur within two (2) seconds. Stable or steady-state operation is defined as operation with terminal voltage remaining constant within plus or minus one (1%) percent of rated voltage. Temperature rise shall not be more than one hundred twenty-five (125) degrees F over forty (40) degrees ambient at rated load. A permanent magnet generator shall provide excitation power to the automatic voltage regulator for immunity from voltage distortion caused by non- linear SCR controlled loads on the unit. The permanent magnet generator shall sustain short circuit current for selective operation and coordination of overcurrent devices.

C. The engine generator set control panel shall be wired, tested, and shock mounted on the generator set by the manufacturer of the alternator. It shall contain: panel lighting; RUN-STOP-REMOTE selector switch; coolant temperature gauge; field circuit breaker; DC voltmeter; running time meter; lamp test switch; oil pressure gauge; fault reset switch; cycle cranking; and low coolant level shutdown. The panel shall contain a twelve (12) light monitor panel with the following: green RUN light; yellow PREWARNING FOR LOW OIL PRESSURE light; yellow PREWARNING FOR HIGH COOLANT TEMPERATURE light; red LOW OIL PRESSURE SHUTDOWN light; red HIGH COOLANT TEMPERATURE SHUTDOWN light; red OVERCRANK SHUTDOWN light; red OVERSPEED SHUTDOWN light; flashing red SWITCH OFF light; yellow LOW COOLANT TEMPERATURE light; yellow

D. The engine generating set shall be mounted on a welded steel base which shall provide for suitable mounting by this Contractor to any level surface. This Contractor shall furnish and install vibration isolators of the number and size required for the total weight of the unit between the steel base and mounting pad.

E. Accessories required for the proper operation of the engine generator set shall be furnished by the manufacturer. These shall include, but not be limited to, the following:

1. Flexible exhaust connectors.

2. Twelve (12) volt lead acid type starting batteries.

3. Battery rack and cables.

4. Additional solenoid valve (shipped loose).

5. This Contractor shall install the additional DC voltage solenoid valve supplied, prior to the flexible fuel line and wire as directed by the engine generator manufacturer to the control circuit to open with the engine operation.

6. Flexible gas lines.

7. Gaseous fuel pressure regulator (to be supplied by the Division 15 Contractor).

8. Single phase, 1.5 kw, 120 volt crank case heater, direct connected. Plug and cord connected type will not be acceptable.

9. Fifty percent (50%) ethylene glycol antifreeze solution to fill engine cooling system.

10. Two (2) 12-volt Form C dry contacts for connection to the fire alarm system graphic annunciator panel for “Generator Run” and “Generator Fault” indications.

11. Two (2) 12-volt Form C dry contacts for connection to the security intrusion system panel for “Generator Run” and “Generator Fault” indications.

F. The engine generator set shall be enclosed with a weather protective housing. The housing shall be rated for sound attenuation to seventy (70) dB(A) average at seven (7) meters when using an eight (8) position measurement system using tests conducted per ANSI S1.13-1971. Acoustical materials shall be oil and water-resistant. A critical silencer muffler shall be mounted inside the housing with raincap and rainshield. The housing shall be attached to the skid base of the generator set and constructed of minimum 14-gauge metal using non-marring fasteners. The access doors shall have both key-lockable door handles and provisions for padlocking and mounted using stainless steel hinges. Paint protection shall be epoxy primer and dual coat electrodeposition method for all sides and all metal surfaces. Overspray of hoses, clamps, wiring and harnesses, and other serviceable items shall not be acceptable.

III. AUTOMATIC TRANSFER SWITCH

A. The complete automatic transfer switch shall be suitable for utility power (source 1) to engine generator set (source 2) application, be completely factory assembled with digital electronic controls designed for surge voltage isolation, and including voltage sensors on all phases of both sources, linear operator, permanently attached manual handles, positive mechanical and electrical interlocking, and mechanically held contacts.

B. The automatic transfer switch shall conform to the requirements of the following codes and standards (latest editions):

1. UL1008. The transfer switch shall be UL listed and labeled.

2. CSA C22.2, No. 14 – M91 Industrial Control Equipment.

3. CSA 282, Emergency Electrical Power Supply for Buildings.

4. NFPA110 – Emergency and Standby Power Systems. The transfer switch shall meet all requirements for level 1 systems.

5. IEEE446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.

6. NEMA ICS10 – AC Automatic Transfer Switches.

C. The transfer switch manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

D. Transfer switch equipment specifications for this project are based on microprocessor-based transfer switches. The transfer switch shall be CUMMINS POWER GENERATION Model OTPC or equal as manufactured by AUTOMATIC SWITCH COMPANY (ASCO) Model 7000 Series.

E. Ratings

1. The transfer switch shall be three pole, four wire, 277/480 volt, 60 hertz, 225 amps.

2. Main contacts shall be rated for 600 Volts AC minimum.

3. Transfer switch(es) shall be rated to carry 100 percent of rated current continuously in the enclosure supplied, in ambient temperatures of - 40 to + 60 degrees C, relative humidity up to 95% (non-condensing), and altitudes up to 10,000 feet (3000M).

4. Transfer switch equipment shall have a minimum withstand and closing ratings (WCR) in RMS symmetrical amperes of 30,000. The transfer switch and its upstream protection shall be third party listed and labeled for use with the specific protective device(s) installed in the application.

F. Construction

1. Transfer switch(es) shall be double-throw, electrically and mechanically interlocked, and mechanically held in the source 1 and source 2 positions. The transfer switch shall be specifically designed to transfer to the best available source if it inadvertently stops in a neutral position.
2. Transfer switches shall be equipped with permanently attached manual operating handles and quick-break, quick-make over-center contact mechanisms.

3. Main switch contacts shall be high-pressure silver alloy. Contact assemblies shall have arc chutes for positive arc extinguishing. Arc chutes shall have insulating covers to prevent inter-phase flashover.

4. Transfer switch internal wiring shall be composed of pre-manufactured harnesses that are permanently marked for source and destination. Harnesses shall be connected to the control system by means of locking disconnect plug(s), to allow the control system to be easily disconnected and serviced without disconnecting power from the transfer switch mechanism.

5. Transfer switch shall be provided with flame retardant transparent covers to allow viewing of switch contact operation but prevent direct contact with line voltage components.

6. Transfer switches shall be provided with a neutral bus and lugs. The neutral bus shall be sized to carry 100% of the current designed on the switch rating.

G. Connections

1. Field control connections shall be made on a common terminal block that is clearly and permanently labeled.

2. Transfer switch shall be provided with AL/CU mechanical lugs sized to accept the full output rating of the generator set.

H. Transfer Switch Control

1. Operator Panel. Each transfer switch shall be provided with a control panel to allow the operator to view the status and control operation of the transfer switch. The operator panel shall be a sealed membrane panel rated NEMA 3R/IP53 or better (regardless of enclosure rating) that is permanently labeled for switch and control functions. The operator panel shall be provided with the following features and capabilities.

a) High intensity LED lamps to indicate the source that the load is connected to (source 1 or source 2); and which source(s) are available. Source available LED indicators shall operate from the control microprocessor to indicate the true condition of the sources as sensed by the control.

b) High intensity LED lamps to indicate that the transfer switch is “not in auto” (due to control being disabled or due to bypass switch enabled or in operation) and “Test/Exercise Active” to indicate that the control system is testing or exercising the generator set.

c) “OVERRIDE” pushbutton to cause the transfer switch to bypass any active time delays for start, transfer, and retransfer and immediately proceed with its next logical operation.

d) “TEST” pushbutton to initiate a preprogrammed test sequence for the

generator set and transfer switch. The transfer switch shall be programmable for test with load or test without load.

e) "RESET/LAMP TEST" pushbutton that will clear any faults present in the control, or simultaneously test all lamps on the panel by lighting them.

f) The control system shall continuously log information on the number of hours each source has been connected to the load, the number of times transferred, and the total number of times each source has failed. This information shall be available via the service tool or an operator display panel.

g) Vacuum fluorescent alphanumeric display panel with push-button navigation switches. The display shall be clearly visible in both bright (sunlight) and no light conditions. It shall be visible over an angle of at least 120 degrees. The Alphanumeric display panel shall be capable of providing the following functions and capabilities.

(1) Display source condition information, including AC voltage for each phase of normal and emergency source, frequency of each source. Voltage for all three phases shall be displayed on a single screen for easy viewing of voltage balance.

(2) Display source status, to indicate source is connected or not connected.

(3) Display load data, including 3-phase AC voltage, 3-phase AC current, frequency, KW, KVA, and power factor. Voltage and current data for all phases shall be displayed on a single screen.

(4) The display panel shall allow the operator to view and make the following adjustments in the control system, after entering an access code:

(a) Set nominal voltage and frequency for the transfer switch.
(b) Adjust voltage and frequency sensor operation set points.
(c) Set up time clock functions.
(d) Set up load sequence functions.
(e) Enable or disable control functions in the transfer switch, including program transition.
(f) Set up exercise and load test operation conditions, as well as normal system time delays for transfer time, time delay start, stop, transfer, and retransfer.

(5) Display Real Time Clock data, including date, and time in hours, minutes, and seconds. The real-time clock shall incorporate provisions for automatic daylight savings time and leap year adjustments. The control shall also log total operating hours for the control system.

(6) Display service history for the transfer switch. Display source connected hours, to indicate the total number of hours connected to each source. Display number of times transferred, and total number of times each source has failed.

(7) Display fault history on the transfer switch, including condition, and date and time of fault. Faults to include controller checksum error, low controller DC Voltage, ATS fail to close on transfer, ATS fail to close on retransfer, battery charger malfunction, network battery voltage low, network communications error.

(8) Display information for other transfer switches in the system, including transfer switch name, real time load in KW on the transfer switch, current source condition, and current operating mode.

I. Internal Controls

1. The transfer switch control system shall be configurable in the field for any operating voltage level up to 600VAC. Provide RMS voltage sensing and metering that is accurate to within plus or minus 1% of nominal voltage level. Frequency sensing shall be accurate to within plus or minus 0.2%. Voltage sensing shall be monitored based on the normal voltage at the site. Systems that utilize voltage monitoring based on standard voltage conditions are not acceptable.

2. Transfer switch voltage sensors shall be close differential type, providing source availability information to the control system based on the following functions:

a) Monitoring all phases of the normal service (source 1) for under voltage conditions (adjustable for pickup in a range of 85 to 98% of the normal voltage level and dropout in a range of 75 to 98% of normal voltage level).

b) Monitoring all phases of the emergency service (source 2) for under voltage conditions (adjustable for pickup in a range of 85 to 98% of the normal voltage level and dropout in a range of 75 to 98% of pickup voltage level).

c) Monitoring all phases of the normal service (source 1) and emergency service (source 2) for voltage imbalance.

d) Monitoring all phases of the normal service (source 1) and emergency service (source 2) for loss of a single phase.

e) Monitoring all phases of the normal service (source 1) and emergency service (source 2) for phase rotation.

f) Monitoring all phases of the normal service (source 1) and emergency service (source 2) for over voltage conditions (adjustable for dropout over a range of 105 to 135% of normal voltage, and pickup at 95-99% of dropout voltage level).

g) Monitoring all phases of the normal service (source 1) and emergency service (source 2) for over or under frequency conditions.

h) Monitoring the neutral current flow in the load side of the transfer switch. The control shall initiate an alarm when the neutral current exceeds a preset adjustable value in the range of 100-150% of rated phase current for more than an adjustable time period of 10 to 60 seconds.

3. All transfer switch sensing shall be configurable from a Windows XP or NT PC-based service tool, to allow setting of levels, and enabling or disabling of features and functions. Selected functions including voltage sensing levels and time delays shall be configurable using the operator panel. The transfer control shall incorporate a series of diagnostic LED lamps.

4. The transfer switch shall be configurable to control the operation time from source to source (program transition operation). The control system shall be capable of enabling or disabling this feature, and adjusting the time period to a specific value. A phase band monitor or similar device is not an acceptable alternate for this feature.

5. The transfer switch shall incorporate adjustable time delays for generator set start (adjustable in a range from 0-15 seconds); transfer (adjustable in a range from 0-120 seconds); retransfer (adjustable in a range from 0-30 minutes); and generator stop (cool down) (adjustable in a range of 0-30 minutes).

6. The control system shall be designed and prototype tested for operation in ambient temperatures from – 20°C to + 60°C.

7. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs, and relays on all outputs, to provide optimum protection from line voltage surges, RFI and EMI.

8. The transfer switch shall be provided with a battery charger for the generator set starting batteries. The battery charger shall be a float type charger rated 10 amps. The battery charger shall include an ammeter for display of charging current and shall have fused AC inputs and DC outputs. The charger shall also include fault indications for high and low DC voltage and supply power failed, and dry contacts for external indication of these fault conditions. Supply power

failed indication shall be displayed on the ATS control panel.

J. Control Interface

1. The transfer switch will provide an isolated relay contact for starting of a generator set. The relay shall be normally held open, and close to start the generator set. Output contacts shall be form C, for compatibility with any generator set.

2. Provide one set of Form C auxiliary contacts on both sides, operated by transfer switch position, rated 10 amps 250 VAC.

K. Enclosure

1. Enclosures shall be UL listed, NEMA Type 1. The enclosure shall provide NEC wire bend space. The cabinet door shall be key-locking.

L. Operation

1. Transfer switch normally connects an energized utility power source (source1) to loads and a generator set (source 2) to the loads when normal source fails. The normal position of the transfer switch is source 1 (connected to the utility), and no start signal is supplied to the genset.

2. Generator Set Exercise (Test) With Load Mode. The control system shall be configurable to test the generator set under load. In this mode, the transfer switch shall control the generator set in the following sequence:

a) Transfer switch shall initiate the exercise sequence at a time indicated in the exercise timer program, or when manually initiated by the operator.

b) When the control systems senses the generator set at rated voltage and frequency, it shall operate to connect the loads to the generator set by opening the normal source contacts, and closing the alternate source contacts a predetermined time period later. The timing sequence for the contact operation shall be programmable in the controller.

c) The generator set shall operate connected to the load for the duration of the exercise period. If the generator set fails during this period, the transfer switch shall automatically reconnect the generator set to the normal service.

d) On completion of the exercise period, the transfer switch shall operate to connect the loads to the normal source by opening the alternate source contacts, and closing the normal source contacts a predetermined time period later. The timing sequence for the contact operation shall be programmable in the controller.

e) The transfer switch shall operate the generator set unloaded for a cool

down period, and then remove the start signal from the generator set. If the normal power fails at any time when the generator set is running, the transfer switch shall immediately connect the system loads to the generator set.

3. Generator Set Exercise (Test) Without Load Mode. The control system shall be configurable to test the generator set without transfer switch load connected. In this mode, the transfer switch shall control the generator set in the following sequence:

   a) Transfer switch shall initiate the exercise sequence at a time indicated in the exercise timer program, or when manually initiated by the operator.

   b) When the control systems senses the generator set at rated voltage and frequency, it shall operate the generator set unloaded for the duration of the exercise period.

   c) At the completion of the exercise period, the transfer switch shall remove the start signal from the generator set. If the normal power fails at any time when the generator set is running, the transfer switch shall immediately connect the system loads to the generator set.

IV. REMOTE ALARM ANNUNCIATOR PANEL

A. Provide and install a 20-light LED type remote alarm annunciator with horn, located as shown on the drawings in the building engineer's office. The remote annunciator shall provide all the audible and visual alarms called for by NFPA Standard 110 for level 1 systems for the local generator control panel. Spare lamps shall be provided to allow future addition of other alarm and status functions to the annunciator. Provisions for labeling of the annunciator in a fashion consistent with the specified functions shall be provided. Alarm silence and lamp test switch(es) shall be provided. LED lamps shall be replaceable, and indicating lamp color shall be capable of changes needed for specific application requirements. Alarm horn shall be switchable for all annunciation points. Alarm horn (when switched on) shall sound for first fault, and all subsequent faults, regardless of whether first fault has been cleared, in compliance with NFPA110 3-5.6.2. The interconnecting wiring between the annunciator and other system components shall be monitored and failure of the interconnection between components shall be displayed on the annunciator panel.

B. The annunciator shall include the following alarm labels, audible annunciation features, and lamp colors:

Condition	Lamp Color	Audible Alarm
Normal Power (to Loads)	Green	No
Genset Supplying Load	Amber	No
Genset Running	Green	No
Not in Auto	Red (Flashing)	Yes

High Battery Voltage	Red	Yes
Low Battery Voltage	Red	Yes
Charger AC Failure	Red	Yes
Fail to Start	Red	Yes
Low Engine Temperature	Amber	Yes
Pre-High Engine Temperature	Amber	Yes
High Engine Temperature	Red	Yes
Pre-Low Oil Pressure	Amber	Yes
Low Oil Pressure	Red	Yes
Overspeed	Red	Yes
Low Coolant Level	Amber	Yes
Low Fuel Pressure	Amber	Yes
Network OK	Green	Yes
(3) Spares	Configurable	Configurable

Low battery voltage lamp shall also be lighted for low cranking voltage or weak battery alarm.

Part 3 - Execution

I. INSTALLATION

A. This Contractor shall furnish and install complete the standby electrical power system including the engine generator set, automatic transfer switch, batteries, exhaust system, vibration isolation, cooling system, electrical system, concrete pad, and accessories in accordance with the system manufacturer's recommendations.

B. The Contractor shall furnish and install a six (6) inch high by six (6) inch greater all sides concrete base foundation for the engine generator set.

1. Concrete foundation shall be as follows:

a) Minimum compressive strength at 28 days – 3500 PSI
b) Maximum nominal aggregate size – 1 inch
c) Maximum W/C ratio by mass – 0.45
d) Air content – 5 + 1%
e. Slump – 2” + 0.75”

2. Top of concrete bases shall be trowel finished smooth and level with beveled edges. Top surface shall not vary by more than 1/8” in depth as measured across the widest surface.

3. All concrete shall be fully vibrated.

4. Reinforcing Steel – Reinforcing to meet ASTM requirements. Spacing of bars shall be adjusted to suit conduit spacing.

C. This Contractor shall ground the generator set as per the NEC, as shown on the

Drawings, and as herein specified.

D. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired. Equipment shall be thoroughly cleaned to remove all dirt and debris.

II. START-UP SERVICE AND ACCEPTANCE TEST

A. Start-up Service: The standby electrical power system's equipment shall be initially started, operated and tested by the manufacturer's representative prior to the "on-site acceptance test".

B. On-Site Acceptance Test: The manufacturer shall furnish service personnel and all testing equipment and temporary cable connections to completely service and field test, in the presence of the Owner, the standby electrical power system. The test shall include, but not be limited to, a "cold start" test, a minimum period of four (4) hours with a load bank test at one hundred percent (100%) of the nameplate rating of the engine generator set and a one-step rated load pickup test in accordance with NFPA 110. The manufacturer shall make any adjustments to the system to assure proper operation. The manufacturer shall then instruct the Owner's personnel as to proper maintenance and operation and furnish three (3) sets of operating, technical, factory service manuals and maintenance instructions, including descriptive literature of equipment, parts list, and the names and telephone numbers of manufacturer's representatives.

III. WARRANTY

A. The warranty for the complete standby electric power system shall be unconditional for a period of one (1) year with unlimited operating hours from the date of the successful acceptance test. The warranty shall be furnished by the system manufacturer. Said coverage shall be for all equipment provided under this specification section whether or not it is manufactured by the Standby Electrical System Manufacturer and shall include parts, labor, travel expenses, and labor to remove/reinstall said equipment per the manufacturer's standard published warranty. There shall be no deductibles applied to said warranty. Multiple warranties for individual components, engine alternator, controls, etc. will not be acceptable. Satisfactory warranty documents shall be furnished. Refer to SECTION 01740 WARRANTIES AND BONDS.

B. Contractor shall provide Warranty Coverage Labels mounted conspicuously on the engine generator control section and on the door of the automatic load transfer switch. The labels shall identify the one source supplier/manufacturer's address and telephone number, coverage description, coverage type, start-up date, model number, serial number, system registration number and other information deemed pertinent by the supplier/manufacturer. It is the intent of this warranty specification to have a single source contact for the Owner to call for warranty service for all standby electrical power system equipment.

C. The manufacturer shall be prepared to offer a service contract for the maintenance of the standby electric power system after the warranty period and/or an extended warranty.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include furnishing and installing a standby electrical power system as shown on the drawings and specified herein.

1. Provide complete factory assembled generator set equipment with digital (microprocessor-based) electronic generator set controls, digital governor, digital voltage regulator, and remote annunciator panel.

2. Provide complete factory assembled power transfer equipment with field programmable digital electronic controls designed for fully automatic operation and including: surge voltage isolation, voltage sensors on all phases of both sources, linear operator, permanently attached manual handles, positive mechanical and electrical interlocking, and mechanically held contacts for both sources.

3. Provide generator-base fuel oil tank (UL 2085).

4. Provide a complete fuel oil transfer pumping system.

5. Provide factory test, startup by a supplier authorized by the equipment manufacturer(s), and on-site testing of the system.

6. The generator set manufacturer shall warrant all equipment provided under this section, whether or not it is manufactured by the generator set manufacturer, so that there is one source for warranty and product service. Technicians specifically trained and certified by the manufacturer to support the product and employed by the generator set supplier shall service the generator sets.

B. The existing standby electrical power system shall remain in operation and shall continue to serve the building's emergency power during the construction period until the new system has been installed and tested, ready for operation. After the new system has assumed the building's entire emergency power load, the existing system shall be removed as shown on the Drawings.

C. The standby “emergency” electrical power system for life safety is a separate system and not a part of this standby electrical power system.

III. SUBMITTALS

A. Submittals are required in accordance with SECTION 16010 of the Specifications, which shall include the following minimum information for review:

1. Manufacturer's product literature and performance data, sufficient to verify compliance to specification requirements.

2. Manufacturer's certification of prototype testing.

3. Manufacturer's published warranty documents.

4. Shop drawings showing plan and elevation views with certified overall dimensions, as well as wiring interconnection details.

5. Interconnection wiring diagrams showing all external connections required; with field wiring terminals marked in a consistent point-to-point manner.

6. Manufacturer's installation instructions.

B. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:

1. Thermal damage curve for generator.

2. Time-current characteristic curves for generator protective device.

C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.
2. Wiring Diagrams: Power, signal, and control wiring.

D. Qualification Data: Manufacturer shall demonstrate they manufacture either the alternator or the generator. Manufacturers that assemble, and do not manufacture the alternator or the generator shall not be permitted.

E. Source quality-control test reports.

1. Certified summary of prototype-unit test report.

2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.

3. Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria for sensitive loads.

4. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.

5. Report of sound generation.

6. Report of exhaust emissions showing compliance with applicable regulations.

7. Certified Torsional Vibration Compatibility: Comply with NFPA 110.

F. Field quality-control test reports.

G. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals.

H. Warranty: Special warranty specified in this Section.

IV. QUALITY ASSURANCE

A. The manufacturer of the generator set shall maintain service parts inventory at a central location which is accessible to the service location 24 hours per day, 365 days per year.

B. The manufacturer shall maintain model and serial number records of each generator set provided for at least 20 years.

C. The generator set shall be serviced by a local service organization that is trained and factory certified in generator set service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call 24 hours per day, 365 days per year, who has had parts and service facilities available locally (within a 50-mile radius of the job site) for the last five (5) years.

D. Factory Testing:

1. The generator set manufacturer shall perform a complete operational test on the generator set prior to shipping from the factory. A certified test report shall be provided. Equipment supplied shall be fully tested at the factory for function and performance.

2. Generator set factory tests on the equipment shall be performed at rated load and rated power factor. Generator sets that have not been factory tested at rated power factor will not be acceptable. Tests shall include: run at full load, maximum power, voltage regulation, transient and steady- state governing, single step load pickup, and function of safety shutdowns.

3. The automatic transfer switch manufacturer shall perform a complete operational test on the transfer switch prior to shipping from the factory. A certified test report shall be available on request. Test process shall include calibration of voltage sensors.

4. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

E. Maintenance Proximity: Not more than four hours' normal travel time from Installer's

place of business to Project site.

F. Engineering Responsibility: Preparation of data for vibration isolators of engine skid mounts, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

1. Manufacturer Qualifications: The manufacturer of the gen set shall be either a manufacturer of the engine or the alternator. Maintain, within 200 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

2. Source Limitations: Obtain packaged generator set, automatic transfer switches and auxiliary components through one source from a single manufacturer.

3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

A. Comply with ASME B15.1.

B. Comply with NFPA 37.

C. Comply with NFPA 70.

D. Comply with NFPA 99.

E. Comply with NFPA 110 requirements for Level 1 emergency power supply system.

F. Comply with UL 2200.

G. Engine Exhaust Emissions: Comply with applicable state and local government requirements.

H. Noise Emission: Comply with applicable state and local government requirements 55db for
maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

G. CODES AND STANDARDS

H. The generator set installation and on-site testing shall conform to the requirements of the following codes and standards, as applicable. The generator set shall include necessary features to meet the requirements of these standards:

1. CSA 282, 1989 Emergency Electrical Power Supply for Buildings

2. IEEE446-Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.

3. NFPA 37

4. NFPA 70 – National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701 and 702.

5. NFPA 99 – Essential Electrical Systems for Health Care Facilities

6. NFPA 110 – Emergency and Standby Power Systems. The generator set shall

   meet all requirements for Level 1 systems. Level 1 prototype tests required by this standard shall have been performed on a complete and functional unit, component level type tests will not substitute for this requirement.

I. The generator set and supplied accessories shall meet the requirements of the following standards, as applicable:

1. NEMA MG1. Alternator shall comply with the requirements of the current version this standard as they apply to AC alternators.

2. UL142 – Sub base tanks.

3. UL2085 – Sub-base tanks.

4. UL1236 – Battery Chargers.

5. UL 2200 Standard for Stationary Engine Generator Assemblies

J. The control system for the generator set shall comply with the following requirements, as applicable:

1. CSA C22.2, No. 14 – M91 Industrial Control Equipment.

2. EN50082-2, Electromagnetic Compatibility – Generic Immunity Requirements, Part 2: Industrial.

3. EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.

4. FCC Part 15, Subpart B.

5. IEC8528 part 4. Control Systems for Generator Sets.

6. IEC STD 801.2, 801.3, and 801.5 for susceptibility, conducted, and radiated electromagnetic emissions.

7. UL508. The entire control system of the generator set shall be UL508 listed and labeled.

8. UL1236. Battery chargers.

K. The automatic transfer switch(es) installation and application shall conform to the

requirements of the following codes and standards:

1. CSA 282, Emergency Electrical Power Supply for Buildings
2. NFPA70 – National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.
3. NFPA99 – Essential Electrical Systems for Health Care Facilities
4. NFPA110 – Emergency and Standby Power Systems. The transfer switch shall meet all requirements for Level 1 systems.
5. IEEE446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.
6. NEMA ICS10-1993 – AC Automatic Transfer Switches.

L. The transfer switch assembly shall comply with the following standards:

1. CSA C22.2, No. 14 – M91 Industrial Control Equipment.
2. EN55011, Class B Radiated Emissions
3. EN55011, Class B Conducted Emissions
4. IEC 1000-4-5 (EN 61000-4-5); AC Surge Immunity.
5. IEC 1000-4-4 (EN 61000-4-4) Fast Transients Immunity
6. IEC 1000-4-2 (EN 61000-4-2) Electrostatic Discharge Immunity
7. IEC 1000-4-3 (EN 61000-4-3) Radiated Field Immunity
8. IEC 1000-4-6 Conducted Field Immunity
9. IEC 1000-4-11 Voltage Dip Immunity.
10. IEEE 62.41, AC Voltage Surge Immunity.
11. IEEE 62.45, AC Voltage Surge.
12. UL1008 – Transfer Switches. Transfer switches shall be UL1008 listed. UL1008 transfer switches may be supplied in UL891 enclosures if necessary to meet the physical requirements of the project.

M. The generator set manufacturer and the automatic transfer switch manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

V. ACCEPTABLE MANUFACTURERS

A. Generator set equipment specifications for this project are based on microprocessor-based generator sets manufactured by CUMMINS POWER GENERATION. Equipment by CATERPILLAR, GENERAC POWER SYSTEMS, or KOHLER POWER SYSTEMS that meets the requirements of this specification shall be acceptable.

B. Automatic transfer switch equipment specifications for this project are based on

microprocessor-based transfer switches manufactured by CUMMINS POWER GENERATION Model OTPC or equal as manufactured by AUTOMATIC SWITCH COMPANY (ASCO) Model 7000 Series.

C. The Cummins Power Generation transfer switches shall be provided with the Cummins Power Generation generator set and the ASCO transfer switches shall be provided with the Caterpillar generator set, to ensure there is one source for warranty and product service.

Part 2 - Products

II. GENERATOR SET

A. Ratings

1. The generator set shall operate at 1800 rpm and at a voltage of: 277/480 Volts AC, Three phase, Four wire, 60 hertz.

2. The generator set rating shall be based on emergency/standby service.

B. Performance

1. Voltage regulation shall be plus or minus 0.5 percent for any constant load between no load and rated load for both parallel and non-parallel applications. Random voltage variation with any steady load from no load to full load shall not exceed plus or minus 0.5 percent.

2. Frequency regulation shall be isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.5%.

3. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.

4. The diesel engine-generator set shall be capable of single step load pick up of 100% nameplate kW and power factor, less applicable derating factors, with the engine-generator set at operating temperature.

5. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.

6. Motor starting capability shall be a minimum of kVA. The generator set shall be capable of recovering to a minimum of 90% of rated no load voltage with the application of the specified kVA load at near zero power factor applied to the generator set. Maximum voltage dip on application of this load, considering both alternator performance and engine speed changes shall not exceed 25%.

7. The alternator shall produce a clean AC voltage waveform, with not more than 5% total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3% in any single harmonic, and no 3rd order harmonics or their multiples. Telephone influence factor shall be less than 40.

    a) The generator set shall be certified by the engine manufacturer to be suitable for use at the installed location and rating, and shall meet all applicable exhaust emission requirements at the time of commissioning.

C. Construction:

1. The engine-generator set shall be mounted on a heavy-duty steel base to maintain alignment between components. The base shall incorporate a battery tray with hold-down clamps within the rails.

2. All switches, lamps, and meters in the control system shall be oil-tight and dust-tight. There shall be no exposed points in the control (with the door open) that operate in excess of 50 volts.

D. Connections.

1. The generator set load connections shall be composed of silver or tin plated copper bus bars, drilled to accept mechanical or compression terminations of the number and type as shown on the Drawings.

2. Sufficient lug space shall be provided for use with cables of the number and size as shown on the Drawings.

3. Power connections to auxiliary devices shall be made at the devices, with required protection located at a wall-mounted common distribution panel.

4. Generator set control interfaces to other system components shall be made on a common, permanently labeled terminal block assembly. Labels describing point functions shall be provided.

III. ENGINE AND ENGINE EQUIPMENT

A. The engine shall be diesel, 4 cycle, radiator and fan cooled. Engine shall be EPA, Tier-? Certified. Minimum displacement shall be cubic inches, with cylinders. The horsepower rating of the engine at its minimum tolerance level shall be sufficient to drive the alternator and all connected accessories. Two cycle engines are not acceptable. Engine accessories and features shall include:

1. An electronic governor system shall provide automatic isochronous frequency regulation. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The control system shall actively control the fuel rate and excitation as appropriate to the state of the generator set. Fuel rate shall be regulated as a function of starting,

accelerating to start disconnect speed and accelerating to rated speed. The governing system shall include a programmable warm up at idle and cool down at idle function. While operating in idle state, the control system shall disable the alternator excitation system.

2. Skid-mounted radiator and cooling system rated for full load operation in 122 degrees F (50 degrees C) ambient as measured at the generator air inlet. Radiator fan shall be suitable for use in a system with 0.5 in H2O restriction. Radiator shall be sized based on a core temperature which is 20˚F higher than the rated operation temperature, or prototype tested to verify cooling performance of the engine/radiator/fan operation in a controlled environment. Radiator shall be provided with a duct adapter flange. The cooling system shall be filled with a 50/50-ethylene glycol/water mixture prior to shipping by the equipment manufacturer. Rotating parts shall be guarded against accidental contact.
3. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 100 percent load condition.
4. Electric starter(s) capable of three complete cranking cycles without overheating.
5. Positive displacement, mechanical, full pressure, lubrication oil pump.
6. Full flow lubrication oil filters with replaceable spin-on canister elements and dipstick oil level indicator.
7. An engine driven, mechanical, positive displacement fuel pump. Fuel filter with replaceable spin-on canister element. Fuel cooler, suitable for operation of the generator set at full rated load in the ambient temperature specified shall be provided if required for operation due to the design of the engine and the installation.
8. Replaceable dry element air cleaner with restriction indicator.

    a) Flexible supply and return fuel lines.

    b) Engine mounted battery charging alternator, 40-ampere minimum, and solid-state voltage regulator.

    c) Coolant heater.

        (1) Engine mounted, thermostatically controlled, coolant heater(s) for each engine. Heater voltage shall be as shown on the project drawings. The coolant heater shall be UL499 listed and labeled.

        (2) The coolant heater shall be installed on the engine with high temperature silicone hose connections. Steel tubing shall be used for connections into the engine coolant system wherever the length of pipe run exceeds 12 inches. The coolant heater installation shall be specifically designed to provide proper

venting of the system. The coolant heaters shall be installed using quick disconnect couplers with provisions to isolate the heater for replacement of the heater element. The quick disconnect/automatic sealing couplers shall allow the heater element to be replaced without draining the engine cooling system or significant coolant loss.

(3) The coolant heater shall be provided with a DC thermostat, installed at the engine thermostat housing. An AC power connection box shall be provided for a single AC power connection to the coolant heater system.

(4) The coolant heater(s) shall be sized as recommended by the engine manufacturer to warm the engine to a minimum of 104˚F (40˚C) in a 40˚F (4˚C) ambient, in compliance with NFPA110 requirements, or the temperature required for starting and load pickup requirements of this specification.

(5) Provide vibration isolators, spring/pad type, quantity as recommended by the generator set manufacturer. Isolators shall include seismic restraints if required by site location.

(6) Starting and Control Batteries shall be calcium/lead antimony type, 24-volt DC, sized as recommended by the engine manufacturer, complete with battery cables and connectors. The batteries shall be capable of a minimum of three (3) complete 15-second cranking cycles at 40˚F ambient temperature when fully charged.

B. Provide exhaust silencer(s) for each engine of size and type as recommended by the generator set manufacturer and approved by the engine manufacturer. The exhaust silencer (muffler) shall be critical grade. Exhaust system shall be installed inside the generator set enclosure.

C. Provide a minimum 12-amp battery charger for each generator set battery bank. Generator sets incorporating two battery banks shall be provided with two charger sets connected together and operated in parallel, with alarm outputs connected in parallel. The chargers shall include the following capabilities:

1. Chargers shall be UL 1236-BBHH listed and CSA or CUL certified for use in emergency applications.

2. The charger shall be compliant with UL 991 requirements for vibration resistance.

3. The charger shall comply with the requirements of EN61000-4-5 for voltage surge resistance; EN50082-2 for immunity; EN61000-4-2 for ESD; EN-61000-4-3 for radiated immunity; ANSI/IEEE C62.41 category B and IN61000-4-4 for electrically fast transient; EN61000-4-6 for conducted emissions; and FCC Part 15 Class A for radiated emissions.

4. The charger shall be capable of charging a fully discharged battery without damage to the charger. It shall be capable of returning a fully discharged battery to fully charged condition within 24 hours. The charger shall be UL-labeled with the maximum battery amp-hour rating that can be recharged within 24 hours. The label shall indicate that the charger is suitable for charging of 220AH batteries per NFPA requirements.

5. The charger shall incorporate a 4-state charging algorithm, to provide trickle charge rate to restore fully discharged batteries, a bulk charge rate to provide fastest possible recharge after normal discharge, an absorption state to return the battery to 100 percent of charge, and a float stage to maintain a fully charged battery and supply battery loads when the generator set is not operating. In addition, the charger shall include an equalization timer. Charge rates shall be temperature compensated based on the temperature directly sensed at the battery.

6. The DC output voltage regulation shall be within plus or minus 1%. The DC output ripple current shall not exceed 1 amp at rated output current level.

7. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.

8. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.

9. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.

10. Ammeter and Voltmeter: Provide integral DC output ammeter and voltmeter Flush mounted in door with five percent accuracy. Meters shall indicate charging rates.

11. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel. Enclosure and Mounting: NEMA 250, Type 3R, mounted on the generator.

12. The charger shall include the following features:

    a) Two-line alphanumeric display with programming keys to allow display of DC output ammeter and voltmeters (5% accuracy or better), display alarm messages, and perform programming;

    b) LED indicating lamp(s) to indicate normal charging condition (green),

equalize charge state (amber), and fault condition (red);

(1) AC input overcurrent, over voltage, and under voltage protection;

(2) DC output overcurrent protection;

(3) Alarm output relay;

(4) Corrosion resistant aluminum enclosure.

13. Battery Heater: Provide thermostatically controlled battery heater to improve starting under cold ambient conditions.

IV. GENERATOR – BASE FUEL TANK

A. ENGINEER, DETERMINE CAPACITY OF FUEL TANK TO OPERATE THE GENSET FOR APPROXIMENTLY 24 HOURS, BUT NOT LARGER THAN 2000 GALLONS. Provide a dual wall sub-base fuel storage tank with gallons capacity. The tank shall be constructed of corrosion resistant steel and shall be UL listed and labeled as complying with UL 142.. The equipment, as installed, shall meet all local and regional requirements for above ground tanks.

B. Certifications

1. Underwriters Laboratories (UL) 2085 Special-Purpose Flammable-Liquid Protected Secondary-Containment Generator-Base Tank Listing

2. The tank must have been tested by UL for:

a) Fire – Not to exceed 260˚ in UL Full-Scale Fire Test

b) Projectile Resistant – UL Section 21

c) Vehicle Impact Resistant – UL Section 20

3. The internal and external tank shall be constructed in accordance with UL 142.

4. The tank shall have an identifying UL Nameplate attached with the following:

a) “Special Purpose Flammable Liquid Tank Protected Secondary Containment Generator Base Tank UL 2085”

b) Tank serial number

c) “This tank is Intended for Installation In Accordance With NFPA 30, NFPA 30A or NFPA 31, NFPA 37, NFPA 110”

d) Manufacturer’s name, location and telephone number

e) Date of manufacture

f) Model number of tank

g) Primary Tank Capacity in Gallons

h) Containment Percentage

i) “Tank Requires Emergency Relief Venting, Capacity Not Less Than Cubic Feet Per Hour, PRIMARY TANK and Cubic Feet Per Hour ANNULAR SPACE”.

j) “Maximum Generator Weight” ”.

k) “Tank Is Intended for Stationary Installation Only. Tank shall be inspected to determine suitability after fire exposure”.

l) “For Diesel Fuel Only”

m) “Pressurize Primary Tank When Pressure Testing Annular Space. Follow Installation Instructions”.

C. Insulation

1. The internal steel tank shall be encased in 6” of LIGHTWEIGHT INSULATING CONCRETE; which is capable of preventing the internal tank temperature from rising not more than 260˚.

2. The insulation shall not contain any aggregates that may act as heat sinks.

3. The insulation shall be a monolithic (seamless) pour and contain no cold joints or multiple concrete sections.

D. Painting

1. Sand blast tank to commercial sandblast standard.

2. Prime coat with Industrial Primer.

3. The entire exterior finish coating shall be petroleum-resistant two-part white.

4. Bottom of tank to be coated with coal-tar epoxy.

E. Construction

1. The internal tank shall be rectangular in shape, listed and constructed in accordance with UL 142 Standard for Generator-Base Tanks.

2. The inner and outer steel tank shall be constructed of minimum 3/16” thick, A-36 Hot Rolled Steel.

3. The tank shall meet seismic zone standards and provide the capability to be anchored as required by local codes for earthquake and/or flood.

4. The internal tank shall be pressure tested and pass a test of 5 psi at the factory.

5. The tank shall be designed with over-spill containment and shall have a 2" interstitial test monitoring pipe.

6. The tank shall include atmospheric and emergency venting nozzles sized to UL requirements.

7. The tank shall have signs to include: Labels to meet applicable codes, product content, and tank capacity. Each nozzle on Flammable, No Smoking, the tank shall be identified for its intended use.

8. The tank shall be designed to meet weight loads of the engine generator set.

9. The tank shall be designed with earthquake, hurricane, and flood tie- down points.

10. Leak detection provisions shall be provided and wired to the generator set control for local and remote alarm indicators.

11. Tank shall be equipped with multiple float switches for high and low fuel levels alarms, activation of fuel oil transfer pumps and for any other requirements of the engine generator set manufacturer and as shown on the drawings. Switches shall be wired to the generator control for local and remote indications. ENGINEER TO EDIT THIS PARAGRAPH, IF NECESSARY.

12. The fuel fill opening shall be recessed in the enclosure wall with a lockable door near the high fuel alarm box.

13. Conduit stub-up sleeves shall be provided for generator set load and control wiring and cabling. Spare couplings shall be provided in tank and rupture basin for customer use. External to the base main rail beams shall be two grounding bosses, one each end opposite corners, for customer grounding requirements.

F. Tank Capacity: Size for minimum of 24 hours of continuous engine generator operation at 100 percent rated load, but not larger than permissible by applicable codes.

1. Features:

a) Direct reading fuel level gage.
b) Normal atmospheric vent.
c) Emergency pressure relief vent.
d) Fuel fill opening with Vandal-resistant lockable cap.
e) Dedicated electrical conduit stub-up area.
f) Low fuel level switch.
g) Leak detection switch; located within secondary containment interstitial space for detection of primary tank fuel leak.

2. Tank supplier shall also provide suitable steps and a man-way platform to provide complete maintenance access to the generator set and enclosure. The platform and stairs shall be constructed of galvanized steel. The platform and stairs shall be minimum 3'-0" in width.

V. AC GENERATOR

A. The AC generator shall be; synchronous, four pole, 2/3 pitch, revolving field, drip- proof construction, single prelubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc. All insulation system components shall meet NEMA MG1 temperature limits for Class H insulation system and shall be UL1446 listed. Actual temperature rise measured by resistance method at full load shall not exceed 105 degrees Centigrade.

B. The generator shall be capable of delivering rated output (kVA) at rated frequency and power factor, at any voltage not more than 5 percent above or below rated voltage.

C. A permanent magnet generator (PMG) shall be included to provide a reliable source of excitation power for optimum motor starting and short circuit performance. The PMG and controls shall be capable of sustaining and regulating current supplied to a single phase or three phase fault at approximately 300% of rated current for not more than 10 seconds.

D. The sub transient reactance of the alternator shall not exceed 15 percent, based on the standby rating of the generator set.

VI. GENERATOR SET CONTROL

A. The generator set shall be provided with a microprocessor-based control system that is designed to provide automatic starting, monitoring, and control functions for the generator set. The control system shall also be designed to allow local monitoring and control of the generator set, and remote monitoring and control as described in this specification.

B. The control shall be mounted on the generator set. The control shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered.

C. The generator set mounted control shall include the following features and functions:

1. Control Switches

a) Mode Select Switch. The mode select switch shall initiate the following control modes. When in the RUN or Manual position, the generator set shall start, and accelerate to rated speed and voltage as directed by the operator. A separate push-button to initiate starting is acceptable. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position, the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.

b) EMERGENCY STOP switch. Switch shall be Red “mushroom- head” push-button. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting. Switch shall have a cover to prevent accidental activation.

c) RESET switch. The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.

d) PANEL LAMP switch. Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.

2. Generator Set AC Output Metering. The generator set shall be provided with a metering set including the following features and functions:

a) Analog voltmeter, ammeter, frequency meter, and kilowatt (KW) meter. Voltmeter and ammeter shall display all three phases. Meter scales shall be color coded in the following fashion: green shall indicate normal operating condition, amber shall indicate operation in ranges that indicate potential failure, and red shall indicate failure impending. Metering accuracy shall be within 1% at rated output.

b) Digital metering set, 1% accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW- hours, and power factor. Generator output voltage shall be available in line-to-line and line-to-neutral voltages, and shall display all three phase voltages (line to neutral or line to line) simultaneously.

c) Both analog and digital metering are required. The analog and digital metering equipment shall be driven by a single microprocessor, to provide consistent readings and performance.

d) The control system shall monitor the total load on the generator set, and maintain data logs of total operating hours at specific load levels ranging from 0 to 110% of rated load, in 10% increments. The control shall display hours of operation at less than 30% load and total hours of operation at more than 90% of rated load.

e) The control system shall log total number of operating hours, total kWH, and total control on hours, as well as total values since reset.

3. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration

4. Generator Set Alarm and Status Display

a) The generator set shall include LED alarm and status indication lamps. The lamps shall be high-intensity LED type. The lamp condition shall be clearly apparent under bright lighting conditions. Functions indicated by the lamps shall include:

(1) The control shall include five (5) configurable alarm- indicating lamps. The lamps shall be field adjustable for any status, warning, or shutdown function monitored by the generator set. They shall also be configurable for color, and control action (status, warning, or shutdown).

(2) The control shall include green lamps to indicate that the generator set is running at rated frequency and voltage, and that a remote start signal has been received at the generator set. The running signal shall be based on actual sensed voltage and frequency on the output terminals of the generator set.

(3) The control shall include a flashing red lamp to indicate that the control is not in automatic state, and red common shutdown lamp.

(4) The control shall include an amber common warning indication lamp.

b) The generator set control shall indicate the existence of the warning and shutdown conditions on the control panel. All conditions indicated below for warning shall be field-configurable for shutdown. Conditions required to be annunciated shall include:

(1) Low oil pressure (warning)

(2) Low oil pressure (shutdown)

(3) Oil pressure sender failure (warning)

(4) Low coolant temperature (warning)

(5) High coolant temperature (warning)

(6) High coolant temperature (shutdown)

(7) High oil temperature (warning)

(8) Engine temperature sender failure (warning)

(9) Low coolant level (warning)

(10) Fail to crank (shutdown)

(11) Fail to start/overcrank (shutdown)

(12)Overspeed (shutdown)

(13)Low DC voltage (warning)

(14)High DC voltage (warning)

(15)Weak battery (warning)

(16)Low fuel-base tank (warning)

(17)High AC voltage (shutdown)

(18)Low AC voltage (shutdown)

(19)Under frequency (shutdown)

(20)Over current (warning)

(21)Over current (shutdown)

(22)Short circuit (shutdown)

(23) Ground fault (warning) (optional – when required by code or specified)

(24)Over load (warning)

(25)Emergency stop (shutdown)

(26)(4) configurable conditions

(27) Provisions shall be made for indication of four customer-specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above specified conditions. The non-automatic indicating lamp shall be red, and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location.

5. Engine Status Monitoring.

   a) The following information shall be available from a digital status panel on the generator set control:

      (1) Engine oil pressure (psi)

      (2) Engine coolant temperature (degrees F)

      (3) Engine oil temperature (degrees F)

(4) Engine speed (rpm)

(5) Number of hours of operation (hours)

(6) Number of start attempts

(7) Battery voltage (DC volts)

b) The control system shall also incorporate a data logging and display provision to allow logging of the last 10 warning or shutdown indications on the generator set, as well as total time of operation at various loads, as a percent of the standby rating of the generator set.

6. Engine Control Functions

a) The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and # of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15-second rest period between cranking periods.

b) The control system shall include an idle mode control, which allows the engine to run in the idle mode in the RUN position only. In this mode, the alternator excitation system shall be disabled.

c) The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting.

d) The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.

e) The control system shall include sender failure monitoring logic for speed sensing, oil pressure and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure conditions.

7. Alternator Control Functions:

a) The generator set shall include a full wave rectified automatic digital voltage regulation system that is matched and prototype tested by the engine manufacturer with the governing system provided. It shall be immune from misoperation due to load- induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase line to neutral RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below an adjustable frequency threshold. Torque matching characteristic shall be adjustable

for roll-off frequency and rate, and be capable of being curve- matched to the engine torque curve with adjustments in the field. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off. Adjustments shall be broad range, and made via digital raise-lower switches, with an alphanumeric LED readout to indicate setting level. Rotary potentiometers for system adjustments are not acceptable.

b) A microprocessor-based protection device shall be provided to individually monitor all phases of the output current of the generator set and initiate an alarm (over current warning) when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (over current shutdown). The protective functions provided shall be in compliance to the requirements of NFPA 70 article 445.

c) A microprocessor-based protection device shall be provided to individually monitor all phases of the output current for short circuit conditions. The control/protection system shall monitor the current level and voltage. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (short circuit shutdown). The protective functions provided shall be in compliance to the requirements of NFPA 70 article 445.

d) Controls shall be provided to monitor the KW load on the generator set, and initiate an alarm condition (over load) when total load on the generator set exceeds the generator set rating for in excess of 5 seconds. Controls shall include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator set is overloaded.

e) A microprocessor-based protection device AC over/under voltage monitoring system that responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds. The system shall monitor individual phases and be connected line to neutral on three-phase, four-wire generator sets, and for systems that are solidly grounded.

f) When required by the National Electrical Code or indicated on the Drawings. The Control System shall include a ground fault monitoring relay. The relay shall be adjustable from 3.8-1200 amps, and include adjustable time delay of 0-10.0 seconds. The relay shall be for indication only, and not trip or shut down the generator set. Note bonding and grounding requirements for the generator set, and provide relay that will function correctly in system as installed.

g) The generator set control shall include a 120 VAC-control heater.

8. Other Control Functions:

a) The generator set shall be provided with a network communication module to allow LonMark compliant communication with the generator set control by remote devices. The control shall communicate all engine and alternator data, and allow starting and stopping of the generator set via the network in both test and emergency modes.

b) A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage is less than 25VDC or more than 32VDC. During engine cranking (starter engaged), the low voltage limit shall be disabled, and if DC voltage drops to less than 14.4 volts for more than two seconds a “weak battery” alarm shall be initiated.

9. Control Interfaces for Remote Monitoring:

a) All control and interconnection points from the generator set to remote components shall be brought to a separate connection box. No field connections shall be made in the control enclosure or in the AC power output enclosure.

b) The control system shall provide four (4) programmable output relays. These relay outputs shall be configurable for any alarm, shutdown, or status condition monitored by the control. The relays shall be configured to indicate: 1) generator set operating at rated voltage and frequency; 2) common warning; 3) common shutdown; load shed command.

c) A fused 10 amp switched 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit whenever the generator set is running.

d) A fused 10 amp 24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit at all times from the engine starting/control batteries.

e) Provide two (2) Form C dry contacts for connection to the fire alarm system graphic annunciator panel for “Generator Run“ and “Generator Fault” indications.

f) Provide two (2) Form C dry contacts for connection to the Security Intrusion System panel for “Generator Run” and “Generator Fault” indications.

g) The control shall be provided with a direct serial communication link for the LonWorks communication network interface as described elsewhere in this specification and shown on the Drawings.

VII. MAIN LINE CIRCUIT BREAKER

A. The generator set shall be provided with a mounted main line 100% rated circuit breaker, sized to carry the rated output current of the generator set. The circuit breaker shall incorporate an electronic trip unit that operates to protect the alternator under all overcurrent conditions, or a thermal-magnetic trip with other overcurrent protection devices that positively protect the alternator under overcurrent conditions. The supplier shall submit time overcurrent characteristic curves and thermal damage curve for the alternator, demonstrating the effectiveness of the protection provided.

VIII. REMOTE ALARM ANNUNCIATOR PANEL

A. Provide and install a 20-light LED type remote alarm annunciator with horn, located as shown on the drawings in the building engineer's office or in a location directed by the Owner. The remote annunciator shall provide all the audible and visual alarms called for by NFPA Standard 110 for level 1 systems for the local generator control panel. Spare lamps shall be provided to allow future addition of other alarm and status functions to the annunciator. Provisions for labeling of the annunciator in a fashion consistent with the specified functions shall be provided. Alarm silence and lamp test switch(es) shall be provided. LED lamps shall be replaceable, and indicating lamp color shall be capable of changes needed for specific application requirements. Alarm horn shall be switchable for all annunciation points. Alarm horn (when switched on) shall sound for first fault, and all subsequent faults, regardless of whether first fault has been cleared, in compliance with NFPA110 3-5.6.2. The interconnecting wiring between the annunciator and other system components shall be monitored and failure of the interconnection between components shall be displayed on the annunciator panel.

B. The annunciator shall include the following alarm labels, audible annunciation features, and lamp colors:

Condition	Lamp Color	Audible Alarm
Normal Power (to Loads)	Green	No
Genset Supplying Load	Amber	No
Genset Running	Green	No
Not in Auto	Red (Flashing)	Yes
High Battery Voltage	Red	Yes
Low Battery Voltage	Red	Yes
Charger AC Failure	Red	Yes
Fail to Start	Red	Yes
Low Engine Temperature	Amber	Yes
Pre-High Engine Temperature	Amber	Yes
High Engine Temperature	Red	Yes
Pre-Low Oil Pressure	Amber	Yes
Low Oil Pressure	Red	Yes
Overspeed	Red	Yes
Low Coolant Level	Amber	Yes
Low Fuel Pressure	Amber	Yes
Network OK Fuel Tank	Green	Yes

Leak	Amber	Yes
(2) Spares	Configurable	Configurable

Low battery voltage lamp shall also be lighted for low cranking voltage or weak battery alarm.

IX. OUTDOOR WEATHER-PROTECTIVE SOUND ATTENUATING HOUSING

A. The generator set shall be provided with a sound-attenuating housing which allows the generator set to operate at full rated load in the ambient conditions previously specified. The enclosure shall reduce the sound level of the generator set while operating at full rated load to a maximum of (Engineer to edit) 76 dBA at any location 7 meters from the generator set in a free field environment. Housing configuration and materials used may be of any suitable design which meets application needs, except that acoustical materials used shall be non- hydroscopic and oil resistant. No foam materials shall be used unless they can be demonstrated to have the same durability and life as fiberglass.

B. Radiator discharge outlet shall be deflected upward, ducted through built-in hood in an approved manner to allow recommended air flow for engine cooling, and to allow minimum clearance in front of the radiator and also help to reduce the sound level of the generator set.

C. The enclosure shall be constructed of minimum 12-gauge steel for framework and 14-gauge steel for panels. All hardware and hinges shall be stainless steel.

D. The enclosure shall include hinged access doors to maintain easy access for all operating and service functions. Key-locking and padlockable door latches shall be provided for all doors, and include retainers to hold the door open during service. Door hinges shall be stainless steel.

E. Enclosure roof shall be cambered to prevent rainwater accumulation. The roof shall be designed for evenly distributed loading of 50 lbs./square foot. The roof shall also be designed to support the largest commercially available silencer in addition to two 250-lb men during normal maintenance procedures. Additional support added for project specific requirements shall be incorporated where required.

F. Provide motorized louvers and dampers to minimize air flow through the enclosure when the generator set is not operating. Louvers shall include provisions to prevent accumulation of ice or snow that might prevent operation.

G. Inlet ducts shall include rain hoods.

H. The enclosure shall be provided with a factory mounted and wired electrical distribution panel to serve the generator set and enclosure. The provisions shall include:

1. 120/208 VAC, 3-phase, 4-wire, 100-amp panelboard connected to the buildings utility service by this Contractor

2. Two GFCI duplex receptacles, one inside the enclosure and one receptacle outside the enclosure with an “in-use” weatherproof cover.

3. Two three-way switches controlling three AC lamps mounted in vapor tight and gasketed fixtures.

4. Factory-wired normal AC service from the panelboard to the engine coolant heaters, alternator heaters, battery charger, etc.

I. The enclosure shall be provided with an exhaust silencer which is mounted inside of the enclosure, and allows the generator set package to meet specified sound level requirements. The exhaust shall exit the enclosure through a rain collar and terminate with a rain cap. Exhaust connections to the generator set shall be through seamless flexible connections.

J. All sheet metal shall be primed for corrosion protection and finish painted in a color selected by the Architect. All surfaces of all metal parts shall be primed and painted.

K. Painting of hoses, clamps, wiring harnesses and other non-metallic service parts shall not be acceptable. Fasteners used shall be corrosion resistant, and designed to minimize marring of the painted surface when removed for normal installation or service work.

L. The enclosure shall include the following maintenance provisions:

1. Flexible coolant and lubricating oil drains lines, which extend to the exterior of the enclosure, with internal drain valves.

2. External radiator fill provision.

M. The enclosure shall have sufficient guards and screens to prevent entrance by small animals.

X. VIBRATION ISOLATION DEVICES

A. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.

2. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.

3. Minimum Additional Travel: 50 percent of required deflection at rated load.

4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6. Minimum Deflection: 1”.

XI. SEQUENCE OF OPERATION -- GENERATOR SET

A. Generator set shall start on receipt of a start signal from remote equipment. The start signal shall be hardwired connection to the generator set control and a redundant signal over the required network connection.

B. The generator set shall complete a time delay start period as programmed into the control.

C. The generator set control shall initiate the starting sequence for the generator set. The starting sequence shall include the following functions:

1. The control system shall verify that the engine is rotating when the starter is signaled to operate. If the engine does not rotate after two attempts, the control system shall shut down and lock out the generator set, and indicate “fail to crank” shutdown.

2. The engine shall fire and accelerate as quickly as practical to start disconnect speed. If the engine does not start, it shall complete a cycle cranking process as described elsewhere in this specification. If the engine has not started by the completion of the cycle cranking sequence, it shall be shut down and locked out, and the control system shall indicate “fail to start”.

3. The engine shall accelerate to rated speed and the alternator to rated voltage. Excitation shall be disabled until the engine has exceeded programmed idle speed, and regulated to prevent over voltage conditions and oscillation as the engine accelerates and the alternator builds to rated voltage.

D. On reaching rated speed and voltage, the generator set shall operate as dictated by the control system in isochronous state.

E. When all start signals have been removed from the generator set, it shall complete a time delay stop sequence. The duration of the time delay stop period shall be adjustable by the operator.

F. On completion of the time delay stop period, the generator set control shall switch off the excitation system and shall shut down.

G. Any start signal received after the time stop sequence has begun shall immediately terminate the stopping sequence and return the generator set to isochronous operation.

XII. FUEL OIL TRANSFER PUMPS

A. Type: The pump shall be positive displacement internal gear rotary type in standard

cast iron construction. Provide cast iron mounting foot.

B. Capacity shall be: suitable for #2 fuel oil and rated for 120 GPH @ 100 PSIG, Motor ¼ horsepower; 120v, single phase.

C. Rotor iron heads shall be hydraulically balanced to assure instant priming and constant flow. Rotor, shaft and idler shall be steel.

D. Seal – The pump shall employ a mechanical face-type seal, with carbon graphite casing bushing.

E. Bearings – the bearing shall be Teflon impregnated outboard type.

F. Motor – Pump shall be mounted on formed steel base direct connected through flexible coupling with guard to 1200-rpm open drip-proof motor.

G. Starter – Provide a manual starter for single-phase units and magnetic across- the-line starter for three phase units. The starter shall have ON-OFF switch and red running light.

H. Provide electric alternator and control panel, control shall include fuel level sensors for pump on-off and high-low level alarms.

I. Package pump set shall be mounted in a NEMA 3R enclosure with hinged access doors or generator enclosure.

XIII. SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.

B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:

a) Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.

b) Full load run.

c) Maximum power.

d) Voltage regulation.

e) Transient and steady-state governing.

f) Single-step load pickup.

g) Safety shutdown.

h) Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.

i) Report factory test results within 10 days of completion of test.

XIV. AUTOMATIC TRANSFER SWITCH (ATS)

A. The complete automatic transfer switch(es) shall be suitable for utility power (source 1) to engine generator set (source 2) application, be completely factory assembled with field programmable digital electronic controls designed for fully automatic operation and including: surge voltage isolation, and including voltage sensors on all phases of both sources, linear operator, permanently attached manual handles, positive mechanical and electrical interlocking, and mechanically held contacts for both sources.

B. Ratings

1. Refer to Drawings for sizes and types of transfer equipment, voltage and ampere ratings, enclosure type, and accessories. Transfer switch(es) rated up to 125 amperes shall be three (3) pole, with solid neutral. Transfer switch(es) rated 150 amperes and above shall be four (4) pole.

2. Main contacts shall be rated for 600 Volts AC minimum.

3. Transfer switch(es) shall be rated to carry 100 percent of rated current continuously in the enclosure supplied, in ambient temperatures of - 40 to + 60 degrees C, relative humidity up to 95% (non-condensing), and altitudes up to 10,000 feet (3000M).

4. Transfer switch equipment shall have withstood and closing ratings (WCR) in RMS symmetrical amperes greater than the available fault currents, but not less than 30,000 for an ATS up to 260 amperes and 65,000 for an ATS larger than 260 amperes, at the specified voltage. The transfer switch shall be third party listed and labeled for use with the specified protective device(s) installed in the application.

C. Construction

1. Transfer switch(es) shall be double-throw, electrically and mechanically interlocked, and mechanically held in the source 1 and source 2 positions. The transfer switch shall be specifically designed to transfer to the best available source if it inadvertently stops in a neutral position.

2. Transfer switches rated through 1000 amperes shall be equipped with permanently attached manual operating handles and quick-make over- center contact mechanisms. Transfer switches over 1000 amperes shall be equipped with manual operators for service use only under de- energized conditions.

3. Main switch contacts shall be high-pressure silver alloy. Contact assemblies

shall have arc chutes for positive arc extinguishing. Arc chutes shall have insulating covers to prevent inter-phase flashover.

4. Transfer switch internal wiring shall be composed of pre-manufactured harnesses that are permanently marked for source and destination. Harnesses shall be connected to the control system by means of locking disconnect plug(s), to allow the control system to be easily disconnected and serviced without disconnecting power from the transfer switch mechanism.

5. Transfer switch shall be provided with flame retardant transparent covers to allow viewing of switch contact operation but prevent direct contact with line voltage components.

6. Four (4) pole transfer switches shall be provided with a switched neutral pole. The neutral pole shall be of the same construction and have the same ratings as the phase poles. All poles shall be switched simultaneously using a common crossbar. Equipment using overlapping neutral contacts is not acceptable.

7. Three (3) pole transfer switches shall be provided with a neutral bus and lugs. The neutral bus shall be sized to carry 100% of the current designated on the switch rating.

D. Connections

1. Field control connections shall be made on a common terminal block that is clearly and permanently labeled.

2. Transfer switch shall be provided with AL/CU mechanical lugs sized to accept the full output rating of the generator set. Lugs shall be suitable for the number and size of conductors shown on the drawings.

E. Transfer Switch Control

1. Operator Panel. Each transfer switch shall be provided with a control panel to allow the operator to view the status and control operation of the transfer switch. The operator panel shall be a sealed membrane panel rated NEMA 3R/IP53 or better (regardless of enclosure rating) that is permanently labeled for switch and control functions. The operator panel shall be provided with the following features and capabilities.

a) High intensity LED lamps to indicate the source that the load is connected to (source 1 or source 2); and which source(s) are available. Source available LED indicators shall operate from the control microprocessor to indicate the true condition of the sources as sensed by the control.

b) High intensity LED lamps to indicate that the transfer switch is “not in auto” (due to control being disabled or due to bypass switch enabled or in operation) and “Test/Exercise Active” to indicate that the control system is testing or exercising the generator set.

c) "OVERRIDE" pushbutton to cause the transfer switch to bypass any active time delays for start, transfer, and retransfer and immediately proceed with its next logical operation.

d) "TEST" pushbutton to initiate a preprogrammed test sequence for the generator set and transfer switch. The transfer switch shall be programmable for test with load or test without load.

e) "RESET/LAMP TEST" pushbutton that will clear any faults present in the control, or simultaneously test all lamps on the panel by lighting them.

f) The control system shall continuously log information on the number of hours each source has been connected to the load, the number of times transferred, and the total number of times each source has failed. This information shall be available via a PC- based service tool and an operator display panel.

g) Vacuum fluorescent alphanumeric display panel with push-button navigation switches. The display shall be clearly visible in both bright (sunlight) and no light conditions. It shall be visible over an angle of at least 120 degrees. The Alphanumeric display panel shall be capable of providing the following functions and capabilities.

(1) Display source condition information, including AC voltage for each phase of normal and emergency source, frequency of each source. Voltage for all three phases shall be displayed on a single screen for easy viewing of voltage balance. Line to neutral voltages shall be displayed for 4-wire systems.

(2) Display source status, to indicate source is connected or not connected.

(3) Display load data, including 3-phase AC voltage, 3-phase AC current, frequency, KW, KVA, and power factor. Voltage and current data for all phases shall be displayed on a single screen.

(4) The display panel shall allow the operator to view and make the following adjustments in the control system, after entering an access code:

(a) Set nominal voltage and frequency for the transfer switch.

(b) Adjust voltage and frequency sensor operation set points.

(c) Set up time clock functions.

(d) Set up load sequence functions.

(e) Enable or disable control functions in the transfer switch, including program transition.

(f) Set up exercise and load test operation conditions, as well as normal system time delays for transfer time, time delay start, stop, transfer, and retransfer.

(5) Display Real Time Clock data, including date, and time in hours, minutes, and seconds. The real-time clock shall incorporate provisions for automatic daylight savings time and leap year adjustments. The control shall also log total operating hours for the control system.

(6) Display service history for the transfer switch. Display source connected hours, to indicate the total number of hours connected to each source. Display number of times transferred, and total number of times each source has failed.

(7) Display fault history on the transfer switch, including condition, and date and time of fault. Faults to include controller checksum error, low controller DC Voltage, ATS fail to close on transfer, ATS fail to close on retransfer, battery charger malfunction, network battery voltage low, network communications error.

(8) Display information for other transfer switches in the system, including transfer switch name, real time load in KW on the transfer switch, current source condition, and current operating mode.

F. Internal Controls

1. The transfer switch control system shall be configurable in the field for any operating voltage level up to 600VAC. Provide RMS voltage sensing and metering that is accurate to within plus or minus 1% of nominal voltage level. Frequency sensing shall be accurate to within plus or minus 0.2%. Voltage sensing shall be monitored based on the normal voltage at the site. Systems that utilize voltage monitoring based on standard voltage conditions are not acceptable.

2. Transfer switch voltage sensors shall be close differential type, providing source availability information to the control system based on the following functions:

a) Monitoring all phases of the normal service (source 1) for under voltage conditions (adjustable for pickup in a range of 85 to 98% of the normal voltage level and dropout in a range of 75 to 98% of normal voltage level).

b) Monitoring all phases of the emergency service (source 2) for under voltage conditions (adjustable for pickup in a range of 85 to 98% of the

normal voltage level and dropout in a range of 75 to 98% of pickup voltage level).

c) Monitoring all phases of the normal service (source 1) and emergency service (source 2) for voltage imbalance.

d) Monitoring all phases of the normal service (source 1) and emergency service (source 2) for loss of a single phase.

e) Monitoring all phases of the normal service (source 1) and emergency service (source 2) for phase rotation.

f) Monitoring all phases of the normal service (source 1) and emergency service (source 2) for over voltage conditions (adjustable for dropout over a range of 105 to 135% of normal voltage, and pickup at 95-99% of dropout voltage level).

g) Monitoring all phases of the normal service (source 1) and emergency service (source 2) for over or under frequency conditions.

h) Monitoring the neutral current flow in the load side of the transfer switch. The control shall initiate an alarm when the neutral current exceeds a preset adjustable value in the range of 100-150% of rated phase current for more than an adjustable time period of 10 to 60 seconds.

3. All transfer switch sensing shall be configurable from a Windows XP or NT PC-based service tool, to allow setting of levels, and enabling or disabling of features and functions. Selected functions including voltage sensing levels and time delays shall be configurable using the operator panel. The transfer control shall incorporate a series of diagnostic LED lamps.

4. The transfer switch shall be configurable to control the operation time from source to source (program transition operation). The control system shall be capable of enabling or disabling this feature, and adjusting the time period to a specific value. A phase band monitor or similar device is not an acceptable alternate for this feature.

5. The transfer switch shall incorporate adjustable time delays for generator set start (adjustable in a range from 0-15 seconds); transfer (adjustable in a range from 0-120 seconds); retransfer (adjustable in a range from 0-30 minutes); and generator stop (cool down) (adjustable in a range of 0-30 minutes).

6. The transfer switch shall be configurable to accept a relay contact signal and a network signal from an external device for load shedding purposes. On receipt of this signal, the transfer switch shall switch to a neutral position when connected to source 2. If source 1 is available when the load-shed signal is received, the transfer switch shall connect to source 1.

7. The transfer switch shall be configurable to accept a relay contact signal and a network signal from an external device to prevent transfer to the generator

service.

8. The transfer switch shall provide a relay contact signal prior to transfer or retransfer. The time period before and after transfer shall be adjustable in a range of 0-50 seconds.

9. The control system shall be designed and prototype tested for operation in ambient temperatures from -40C to +70C. It shall be designed and tested to comply with the requirements of the noted voltage and RFI/EMI standards.

10. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs, and relays on all outputs, to provide optimum protection from line voltage surges, RFI and EMI.

11. The transfer switch network monitoring equipment, when supplied, shall be provided with a battery based auxiliary power supply to allow monitoring of the transfer switch when both AC power sources are non- operational. The battery power supply shall be monitored for proper condition, and the transfer switch shall include an alarm condition to indicate low battery condition.

G. Control Interface

1. The transfer switch will provide an isolated relay contact for starting of a generator set. The relay shall be normally held open, and close to start the generator set. Output contacts shall be form C, for compatibility with any generator set.

2. Provide one set of Form C auxiliary contacts on both sides, operated by transfer switch position, rated 10 amps 250 VAC.

3. The transfer switch shall provide relay contacts to indicate the following conditions: source 1 available, load connected to source 1, source 2 available, source 2 connected to load.

4. The transfer switch shall be provided with a network communication card, and configured to allow LonMark compliant communication with the transfer switch and other network system components. The network shall provide a redundant start signal to the generator set(s) in the system.

H. Enclosure

1. Enclosures shall be UL listed, NEMA Type 1 or better or as shown on the Drawings. The cabinet shall provide code-required wire bend space. Manual operating handles and all control switches (other than key-operated switches) shall be accessible to authorized personnel only by opening the key-locking cabinet door. Transfer switches with manual operating handles and/or non-key- operated control switches located on outside of cabinet do not meet this specification and are not acceptable.

XV. SEQUENCE OF OPERATION – AUTOMATIC TRANSFER SWITCH(ES)

A. Transfer switch normally connects an energized utility power source (source1) to loads and a generator set (source 2) to loads when normal source fails. The normal position of the transfer switch is source 1 (connected to the utility), and no start signal is supplied to the generator set.

B. Standby electrical power systems for Prince George's County Shelters shall have a remote manual override switch(es) of the type and locations shown on the Drawings. The override switch shall have two settings, NORMAL MODE and SHELTER MODE. NORMAL MODE switch position shall not allow the transfer switch to send a start signal to the generator set to operate upon loss of utility power. SHELTER MODE switch position shall allow the generator set to operate upon loss of utility power and the transfer switch to transfer the loads to the generator set.

C. Generator Set Exercise (Test) With Load Mode. The control system shall be configurable to test the generator set under load. In this mode, the transfer switch shall control the generator set in the following sequence:

1. Transfer switch shall initiate the exercise sequence at a time indicated in the exercise timer program, or when manually initiated by the operator.

2. When the control systems sense the generator set at rated voltage and frequency, it shall operate to connect the loads to the generator set by opening the normal source contacts, and closing the alternate source contacts a predetermined time period later. The timing sequence for the contact operation shall be programmable in the controller.

3. The generator set shall operate connected to the load for the duration of the exercise period. If the generator set fails during this period, the transfer switch shall automatically reconnect the generator set to the normal service.

4. On completion of the exercise period, the transfer switch shall operate to connect the loads to the normal source by opening the alternate source contacts, and closing the normal source contacts a predetermined time period later. The timing sequence for the contact operation shall be programmable in the controller.

5. The transfer switch shall operate the generator set unloaded for a cool down period, and then remove the start signal from the generator set. If the normal power fails at any time when the generator set is running, the transfer switch shall immediately connect the system loads to the generator set only when the remote manual override switch is set to "SHELTER MODE", otherwise the generator set shall continue with the normal exercise sequence.

D. Generator Set Exercise (Test) Without Load Mode. The control system shall be configurable to test the generator set without transfer switch load connected. In this mode, the transfer switch shall control the generator set in the following sequence:

1. Transfer switch shall initiate the exercise sequence at a time indicated in the exercise timer program, or when manually initiated by the operator.

2. When the control systems senses the generator set at rated voltage and

frequency, it shall operate the generator set unloaded for the duration of the exercise period.

3. At the completion of the exercise period, the transfer switch shall remove the start signal from the generator set. If the normal power fails at any time when the generator set is running, the transfer switch shall immediately connect the system loads to the generator set only when the remote manual override switch is set to “SHELTER MODE”, otherwise the generator set shall continue with the normal exercise sequence.

Part 3 - Execution

III. EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.

B. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

IV. INSTALLATION

A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.

B. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.

C. Install packaged engine generator with 1.5” restrained spring isolators having a minimum deflection of on 4-inch- high concrete base. Secure sets to anchor bolts installed in concrete bases.

D. This Contractor shall furnish and install complete the standby electrical power system including the engine generator set, automatic transfer switch(es), batteries and charging system, exhaust system, vibration isolation, cooling system, electrical system, concrete pad, generator-base fuel tank, man-way platforms, enclosure, and accessories in accordance with the system manufacturer's recommendations.

E. Equipment shall be installed by this Contractor in accordance with final submittals and contract documents. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer’s instructions and instructions included in the listing or labeling of UL listed products.

F. Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. The contractor shall also perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier.

G. The Contractor shall furnish and install a concrete base for the engine generator set and generator base fuel tank, as shown on the drawings. Equipment shall be permanently fastened to the concrete pad in accordance with the manufacturer's instructions.

1. Concrete foundation shall be as follows:

a) Minimum compressive strength at 28 days – 3500 PSI

b) Maximum nominal aggregate size – 1 inch

c) Maximum W/C ratio by mass – 0.45

d) Air content – 5 + 1%

e) Slump – 2" + 0.75"

2. Top of concrete bases shall be trowel finished smooth and level with beveled edges. Top surface shall not vary by more than 1/8" in depth as measured across the widest surface.

3. All concrete shall be fully vibrated.

4. Reinforcing Steel – Reinforcing to meet ASTM requirements. Spacing of bars shall be adjusted to suit conduit spacing.

H. This Contractor shall ground the generator set as per the NEC, as shown on the Drawings, and as herein specified.

I. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired. Equipment shall be thoroughly cleaned to remove all dirt and debris prior to initial operation and final testing of the system.

J. All fuel tanks shall be field testing in accordance with the requirements of the authority having jurisdiction (AHJ). All fuel tanks shall be filled to full capacity by this Contractor after final testing and Owner acceptance.

V. START-UP SERVICE AND ACCEPTANCE TEST

A. Start-up Service: The standby electrical power system's equipment shall be initially started, operated and tested by the manufacturer's representative prior to the "on-site acceptance test". The Owner shall be notified in advance before any testing in order to coordinate any possible disruption or downtime with the school or facility.

B. On-Site Acceptance Test:

1. The manufacturer shall furnish service personnel and all testing equipment and temporary cable connections to completely service and field test, in the presence of the Owner, the standby electrical power system.

2. The test shall include, but not be limited to, a “cold start” test, a minimum period of four (4) hours with a load bank test at one hundred percent (100%) of the nameplate rating of the engine generator set and a one-step rated load pickup test in accordance with NFPA 110. The manufacturer shall make any adjustments to the system to assure proper operation.

3. The manufacturer shall instruct the Owner's personnel as to proper maintenance and operation and furnish three (3) sets of operating, technical, factory service manuals and maintenance instructions, including descriptive literature of equipment, parts list, and the names and telephone numbers of manufacturer's representatives.

4. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.

   a) Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.3

   b) Test for contact integrity of all connectors. Perform an integrity load test and capacity load test for the battery.

   c) Verify acceptance of charge for each element of the battery after discharge.

   d) Verify that measurements are within manufacturer's specifications.

5. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float charging conditions.

6. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.

7. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch. Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.

8. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.

9. Harmonic-Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.

C. Coordinate tests with tests for transfer switches and run them concurrently.

D. Test instruments shall have been calibrated within the last 12 months, traceable to

standards of NIST, and adequate for making positive observation of test results. Make calibration records available for examination on request.

VI. SOFTWARE AND TRAINING

A. The manufacturer shall supply to the Owner a complete set of service and maintenance software for use in properly supporting the product. The software shall be provided at a training class attended by the Owner's personnel, to qualify them in proper use of the software. The software shall have the following features and capabilities:

1. The software shall be 32 bit and shall be Windows '95, Windows '98, XP, and NT compatible.

2. The software shall use the Windows "Explorer" format, for ease of use and commonality with other software in use at the facility.

3. The software shall allow adjustment of all functions described herein via the tool; adjustment of operating levels of all protective functions; and programming of all optional functions in the controller. Adjustments shall be possible over modem from a facility that is remote from the generator set.

4. The software shall allow simulation of fault conditions, to verify operation of all protective devices.

5. The software shall include the ability to store and display data for any function monitored by the generator set control. This data shall be available in common file formats, and on graphical "strip chart" displays.

6. The software shall automatically record all control operations and adjustments performed by any operator or software user, for tracking of changes to the control.

7. The software shall display all warning, shutdown, and status changes programmed into transfer switch controller. For each event, the control shall provide information on the nature of the event, when it last occurred, and how many times it has occurred.

8. The software shall include detailed operation and service information on the specific generator set supplied, so that no other documentation (other than schematic and wiring diagram drawings) is necessary for service of the product.

9. The software shall have been developed under strict quality control guidelines, and comply with the requirements of ISO 9001 and Mil Standard 498 for software development.

B. After generator set installation and successful acceptance test, the generator set supplier shall conduct a complete operation, basic maintenance, and emergency service seminary for up to 10 persons employed by the Owner. The seminary shall include instruction on operation of the transfer equipment, normal testing and exercise,

adjustments to the control system, use of the PC based service and maintenance tools provided under this contract, and emergency operation procedures. The class duration shall be at least 8 hours in length, and include practical operation with the installed equipment.

VII. WARRANTY

A. The warranty for the complete standby electric power system shall be unconditional for a period of one (1) year with unlimited operating hours from the date of the successful acceptance test. The warranty shall be furnished by the system manufacturer. Said coverage shall be for all equipment provided under this specification section whether or not it is manufactured by the Standby Electrical System Manufacturer and shall include parts, labor, travel expenses, and labor to remove/reinstall said equipment per the manufacturer's standard published warranty. There shall be no deductibles applied to said warranty. Multiple warranties for individual components, engine alternator, controls, etc. will not be acceptable. Satisfactory warranty documents shall be furnished. Refer to SECTION 01740 WARRANTIES AND BONDS.

B. Contractor shall provide Warranty Coverage Labels mounted conspicuously on the engine generator control section and on the door of the automatic load transfer switch. The labels shall identify the one source supplier/manufacturer's address and telephone number, coverage description, coverage type, start-up date, model number, serial number, system registration number and other information deemed pertinent by the supplier/manufacturer. It is the intent of this warranty specification to have a single source contact for the Owner to call for warranty service for all standby electrical power system equipment.

C. The manufacturer shall be prepared to offer a service contract for the maintenance of the standby electric power system after the warranty period and/or an extended warranty.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work under this Section shall include furnishing and installing Surge Protective Devices (SPDs), formerly TVSS, for the protection of AC electrical circuits as shown on the Drawings and herein specified.

III. QUALITY ASSURANCE

A. All equipment, materials, and their installation shall conform to the requirements of the National Electrical Code (NEC), local code requirements, and these Specifications.

B. SPD units and all components shall be designed, manufactured and tested in accordance with the most recent editions of ANSI/UL 1449 and UL 1283.

C. Equipment shall be constructed in accordance with National Electrical Manufacturer's Association (NEMA) standards (NEMA LS-1).

D. Submittals are required in accordance with SECTION 16010 of these Specifications. The submittals shall contain, at a minimum, the following:

1. Provide verification that the SPD complies with the required ANSI/UL 1449 3rd Edition listing by Underwriters Laboratories (UL) or other Nationally Recognized Testing Laboratory (NRTL) acceptable to Prince George's Department of the Environment (DoE). Compliance may be in the form of a file number that can be verified on UL's website or on any other NRTL's website, as long as the website contains the following information at a minimum: model number, SPD Type, system voltage, phases, modes of protection, Short Circuit Current Rating (SCCR), Voltage Protection Ratings (VPRs) for all modes, Maximum Continuous Operating Voltage rating (MCOV) and Nominal Discharge Current (In). UL data and visual inspection takes precedence over manufacturer's published documentation.

2. For SPD, external mounting applications include electrical/mechanical drawings showing unit dimensions, weights, installation instruction details, and wiring configuration.

3. Where applicable the following additional information shall be included in the submittals:

a) Descriptive bulletins.

b) Product sheets.

Part 2 - Products

I. MANUFACTURERS

A. Subject to compliance, the following SPD manufacturers are acceptable: ADVANCED PROTECTION TECHNOLOGIES (APT) as listed herein or TOTAL PROTECTION SOLUTIONS (TPS) or SURGE SUPPRESSION INC, EATON ELECTRICAL INC., SIEMENS ENERGY & AUTOMATION, SQUARE D; a brand of SCHNEIDER ELECTRIC or the switchboard manufacturers SPD's for internal or external mounting in or on switchboards shall also be acceptable. Panelboard manufacturers SPD's for external mounting only shall also be acceptable.

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features, and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

II. VOLTAGE SURGE SUPPRESSION – GENERAL

A. Electrical Requirements:

1. Refer to Drawings for operating voltages and unit configurations.

2. SPD's shall be UL labeled with 200kA Short Circuit Current Rating (SCCR). Fuse ratings shall not be considered in lieu of demonstrated withstand testing SPDs.

3. Maximum Continuous Operating Voltage (MCOV):

System Voltage	Allowable System Voltage Fluctuation (%)	MCOV
208Y/120	25%	150V
480Y/277	15%	320V

4. The suppression system shall incorporate thermally protected metal- oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.

5. The SPD shall provide surge current path for all modes of protection: L-N, L-G,

and N-G for Wye systems; L-L, L-G in Delta and impedance grounded Wye systems.

6. All SPD's applied to the distribution system shall have a 20kA Nominal Discharge Current (In) rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an In less than 20kA shall not be acceptable.

7. ANSI/UL 1449 Listed Voltage Protection Ratings (VPRs) shall not exceed the following:

System Voltage	L-N	L-G	L-L	N-G
208Y/120	800V	800V	1200V	800V
480Y/277	1200V	1200V	2000V	1200V

(Numerically lower is allowed/preferred; old-style Suppressed Voltage Ratings (SVRs) shall not be submitted, nor evaluated due to outdated less-strenuous testing).

B. SPD Design:

1. SPD shall be UL listed Type 1 or Type 2, intended for use without need for external or supplemental overcurrent controls. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal over temperature controls. SPD's relaying upon external or supplementary installed safety disconnects do not meet the intent of this specification.

2. The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.

3. The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable SPD modules shall not be accepted.

4. SPD shall have UL 1283 EMI/RFI filtering with minimum attenuation of 50dB at 100kHz.

5. SPD shall include visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service LED. SPD shall include an audible alarm with on/off silence function and diagnostic test function. SPDs for branch circuit panels not employing an on/off silence function will be acceptable.

6. The SPD must include Form C dry contacts (one NO and one NC) for remote monitoring of its status. Both the NO and NC contacts shall change state under any fault condition or if power is removed from the SPD. Service entrance locations shall have two sets of NO and NC contacts for building power monitoring.

7. SPDs at service entrance locations shall be provided with a surge event counter with a reset button allowing the surge counter to be zeroed. The surge event count shall have a lithium battery backup or be stored in non- volatile memory and displayed after power is restored.

8. Internally mounted SPDs in switchboards shall be designed to interface with the electrical assembly via factory installed conductors only and not mounted directly to bus bars.

9. Sidemount SPDs shall be factory sealed in order to prevent access to the inside of the unit. Sidemount SPDs shall have factory installed phase, neutral, ground and remote status contact conductors factory installed and shall have a pigtail of conductors protruding outside of the enclosure for field installation. Top mount SPDs for switchboards where sidemount is not feasible due to space constrictions or space allowed for future expansion.

C. SPDs shall have NEMA 1 general purpose enclosures, unless otherwise noted or required for the environment. SPDs located in kitchens or other areas subject to possible water exposure shall be NEMA 4X.

III. SYSTEM APPLICATION

A. The SPD applications covered under this section include switchboard assemblies, motor control centers (if present), distribution and branch circuit panelboards. All SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C, B, and A environments.

B. The minimum current capability (single pulse rated) per phase shall be:

Service Entrance or Automatic Transfer Switch: 50kA

Distribution Panelboards & MCC: 150kA

Branch Circuit Panelboards: 100kA

C. SPDs installed on the load side of the service entrance disconnect shall be Type

1. Other SPD locations beyond the service entrance shall be Type 1 or Type 2.

IV. SERVICE ENTRANCE SWITCHBOARD/PANELBOARD LOCATIONS

A. The SPD application covered under this section is for service entrance switchboard(s). Service entrance located SPDs shall be tested and demonstrated suitability for application within ANSI/IEEE C62.41 Category C environments.

B. The SPD shall be from the same manufacturer as the switchboard. The SPD shall be internal and panel mounted in the front face of the switchboard at the assembly point by the original equipment manufacturer. Alternatively, the SPD from the same or different manufacturer may be mounted external to the switchboard.

C. The SPD for service entrance distribution panelboards shall be mounted external and adjacent to the panelboard.

D. Locate the SPD (Type 1) on the load side of the main disconnect device, as close as possible to the phase conductors and the ground neutral bar.

E. The SPD shall be connected through a three pole, 60A circuit breaker to serve as the disconnecting means for the SPD. This disconnect shall be located in immediate proximity to the SPD. Connections shall be made via conductors originating in the SPD and shall be kept as short as possible.

1. As an option, internal mounted SPD's in switchboards may be provided with an integral disconnect switch in lieu of using a 60A circuit breaker to serve as the SPD disconnecting means. Connections shall be made via conductors originating in the SPD and connected to the bus bars with suitably sized tap lugs, factor installed. Conductors shall be kept as short as possible.

F. All monitoring and diagnostic features shall be visible from the front of the equipment.

G. The service entrance distribution panelboard external SPD shall be ADVANCED PROTECTION TECHNOLOGIES (APT) Model No.:

1. TE02XAS25E1X for 120/208V SE distribution panelboards

2. TE04XAS25E1X for 277/480V SE distribution panelboards

V. POWER DISTRIBUTION AND BRANCH CIRCUIT PANELBOARD LOCATIONS

A. The SPD application covered under this section includes distribution and branch circuit panelboards. The SPD units shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category B environments.

B. The SPD shall be mounted externally and adjacent to the panelboard. The SPD shall be connected through a three pole, 30A circuit breaker to serve as the disconnecting means for the SPD. Connections shall be made via conductors originating in the SPD and shall be kept as short as possible.

C. SPDs shall be flush mounted adjacent flush mounted panelboards and surface mounted adjacent to or attached to surface mounted panelboards.

D. The external SPD shall be ADVANCED PROTECTION TECHNOLOGIES (APT) Model No.:

1. TE02XDS154XA for 120/208V distribution panelboards

2. TE04XDS154XA for 277/480V distribution panelboards

3. TE02XDS104XA for 120/208V branch circuit panelboards

4. TE04XDS104XA for 277/480V branch circuit panelboards

E. SPDs for motor control centers (MCC) shall be from the same manufacturer as the MCC. The SPD shall be internal and panel mounted in the front face of the MCC at the assembly point by the original equipment manufacturer. Alternatively, the SPD from the same or different manufacturer may be mounted external to the MCC. All monitoring and diagnostic features shall be visible from the front of the equipment.

Part 3 - Execution

I. INSTALLATION

A. SPD shall be installed per manufacturer's installation instructions with lead lengths as short (less than 24") and straight as possible. Gently twist conductors together.

B. This Contractor may reasonably rearrange the circuit breaker locations to ensure the shortest and straightest possible leads for the SPD connections.

C. Before energizing, this Contractor shall verify service and separately derived system neutral to ground bonding jumpers per the National Electrical Code.

D. Repaint marred and scratched surfaces with touch-up paint to match original finish.

II. TRAINING

A. This Contractor shall provide four (4) hours of technical service training to the Owner's technical and maintenance staff.

B. The training session shall be conducted by a manufacturer's qualified representative. The training program shall consist of instruction on operation of the assembly.

III. WARRANTY

A. SPDs and supporting components and accessories shall be guaranteed by the manufacturer to be free of defects in material and workmanship for a period of ten (10) years from the date of substantial completion of service and activation of the system to which the suppressor is attached. Additionally, during the applicable warranty period, and SPD which fails due to any electrical anomaly, including lightning, shall be replaced by the manufacturer without charge. Special or optional warranties in excess of the warranty period for purposes of this bid are not acceptable. Standard unit warranties in excess of the warranty period stated herein are acceptable. Refer to SECTION 01740 for the start of the warranty period.

B. Since "Acts of Nature" or similar statements typically include the threat of lightning to which the SPDs shall be exposed, any such clause limiting warranty responsibility in the

general conditions of this specification shall not apply to this particular section. The warranty must specifically provide for unlimited free replacements of the SPD in the event of failure caused by the effects of lightning and all other electrical anomalies. The warranty shall cover the entire device, not just various components, such as modules only.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include furnishing and installing light- emitting diode (L.E.D.) luminaires (lighting fixtures) complete as shown on the Drawings, as described in the “Luminaire (Lighting Fixture) Schedule", and as herein specified.

III. QUALITY ASSURANCE

A. This contractor shall provide luminaires that are of a manufacturer engaged in the production of luminaires that are equal in material, design and workmanship. The manufacturer’s luminaire shall have been in satisfactory commercial or industrial use for a minimum of three (3) years. The manufacturer’s luminaire shall have been available on the commercial market during the three (3) year period.

B. L.E.D. luminaires shall conform to the requirements of the National Electrical Code (NEC), state and local codes, and these Specifications.

C. The luminaires shall be listed by Underwriters Laboratories, Inc. (UL) or listed by a nationally recognized testing laboratory acceptable to Prince George’s County DoE.

D. Submittals are required in accordance with SECTION 260500 of these Specifications.

IV. DESCRIPTION

A. This Contractor shall furnish, assemble, and install L.E.D. luminaires complete with sockets, louvers, lenses, internal wiring, leads, trims, rings, frames, hangers, straps, reflectors, light engine, and power supply unit (driver) as applicable and required for a complete installation.

B. Luminaires that require remote mounting of any components needed for its operation, such as drivers, or light engine electronics are not permitted. All components needed to make the luminaire operational shall be integral to the luminaire housing.

V. WARRANTY

A. This Contractor shall deliver the work described herein in first class operating condition in every respect. This Contractor shall also warrant that the material and workmanship shall be entirely free from defects. Any materials, equipment, or workmanship in which defects may develop before or during the warranty period shall be repaired or replaced at the Contractors own expense. Refer to SECTION 01740 for the start of the warranty period. The contractor shall further warrant that all material, equipment, and

workmanship used in the installation, but not specifically mentioned in the Drawings and Specifications, is the best of their respective kinds and that the construction and installation was performed in accordance with the best accepted standard practices in all details.

Part 2 - Products

I. MATERIALS AND COMPONENTS

A. The L.E.D. luminaires supplied shall have the proper trim, frames, mounting devices, configuration, and accessories necessary to be properly installed in the building construction. Catalog numbers of luminaires in the “Luminaire Schedule” or "Lighting Fixture Schedule" on the Drawings are to establish a type of luminaire and not to determine a method of mounting.

1. Catalog numbers scheduled on the Drawings may indicate luminaire compatibility with certain types of ceiling construction. The Contractor shall determine exact type of ceilings actually to be furnished in each area and shall obtain luminaires to suit, deviating from specified catalog numbers or descriptions only where necessary, and only to the extent necessary to insure luminaire-ceiling compatibility. The Contractor shall notify the Architect/Engineer and Owner in writing where such changes are to be made.

B. Where L.E.D. luminaires are specified on the Drawings to be complete with a flat diffusing lens, the lens shall be virgin acrylic Type 19 pattern with a minimum thickness of 0.156 inches unless otherwise shown on the Drawings.

C. When L.E.D. luminaires are specified on the Drawings to be complete with a curved or rounded lens refractor/diffuser, the lens shall be impact resistant 100% virgin acrylic type with diffusing optical film.

D. Double lock nuts shall be used at the load bearing ends of threaded pipe used as part of a stem mounting assembly.

E. Approved[1] lay-in type fixture manufacturers include:

II. POWER SUPPLY UNIT (DRIVERS)

A. Luminaires shall be equipped with an L.E.D. driver(s) that accepts the voltage as indicated on the "Luminaire (Lighting Fixture) Schedule". Individual driver(s) shall be replaceable.

B. Driver(s) shall be UL8750 class 2 compliant for their intended purpose.

C. Total harmonic distortion (THD) for current: ≤ 20%

D. Driver(s) shall be rated to operate between -30ºC to 50ºC minimum.

E. Individual driver(s) shall be equipped with surge protection (6kV minimum) in accordance with IEEE/ANSI C62.4.1. Driver shall be protected against damage due to either an open circuit or short circuit fault condition on the driver output.

F. Driver(s) shall have a minimum efficiency of 85%.

G. Drivers shall deliver full-range dimming from 0-10V control signal.

H. Electronic Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.

III. L.E.D. LIGHT SOURCE (LIGHT ENGINE)

A. Individual light engine(s) shall be replaceable.

B. L.E.D. light engine(s) shall have a minimum lifetime of 50,000+ hours at 40º C and shall have a minimum efficiency of 80 lumens per watt.

C. L.E.D. dies shall be tested in accordance with I.E.S.N.A. LM-80-08 standards.

D. Thermal management shall be passive by design and shall consist of heat sinks with no fans, pumps, or liquids.

IV. SPARE PARTS

A. The Contractor shall furnish to the Owner at the completion of the project, a minimum of 5% spare L.E.D. driver assemblies. LED drivers shall be turned over to the Owner representative in their manufacturer's protective packaging. LED drivers not in their protective packaging will not be acceptable.

B. The Contractor shall furnish to the Owner at the completion of the project, a minimum of 5% spare L.E.D. light engine assemblies. LED light engines shall be turned over to the Owner representative in their manufacturer's protective packaging. L.E.D. light engines not in their protective packaging will not be acceptable.

V. EXIT LIGHTS

A. Exit lights (signs) shall be universal mount and complete with factory installed light-emitting diodes (L.E.D.'s) mounted behind a red diffusing panel and with direction arrows as shown on the Drawings.

1. Housing: Thermoplastic.

2. Finish: White.

3. Mounting Type: Universal.

4. Number of Faces: Single, with extra faceplate and color panel for field conversion to double-faced.

5. Letter Color: Red

6. Emergency Operation: Self-powered.

7. Battery: Nickel cadmium.

8. Voltage: Dual 120/277 V.

B. Exit lights shall have wire guards where shown on the Drawings.

Part 3 - Execution

I. INSTALLATION

A. L.E.D. luminaires (lighting fixtures) shall be installed as shown on the Drawings and in accordance with the manufacturer's recommendations.

B. Recessed lay-in type linear L.E.D. luminaires shall be supported from the building structure independently of the ceiling grids with a minimum of four (4) steel tie wires per luminaire or as detailed on the Drawings.

C. Recessed lay-in type linear L.E.D. luminaires installed in lay-in type ceiling tile shall be securely fastened from the building structure and be installed in the lay- in type ceiling in such a manner that the louver/lens housing may be easily opened and so that the luminaires may be removed and relocated without forcing the luminaires or changing the grid system tie wires. This Contractor shall coordinate with the ceiling installer before the ceiling grid is installed to assure a mutually satisfactory installation of ceiling and luminaires.

D. Recessed L.E.D. luminaires installed in “hard” ceiling systems (i.e. drywall, metal pan, etc.) shall be securely fastened from the building structure and be installed in such a manner that the louver/lens housing may be easily opened and so that the luminaires may be removed and relocated without forcing the luminaires or changing the ceiling support system. This Contractor shall coordinate with the ceiling installer before the ceiling is installed to assure a mutually satisfactory installation of ceiling and luminaires.

E. Surface mounted linear L.E.D. luminaires shall be supported from the building structure with a minimum of two (2) 1/4 inch threaded rods per each one (1) foot wide by four (4) foot long and a minimum of four (4) 1/4 inch threaded rods per each two (2) foot wide by four (4) foot long luminaire as detailed on the Drawings.

F. Pendant/suspended luminaires shall be supported from the building structure with 1/4 inch threaded rods at each of the luminaires suspension points. Hardware connections to the threaded rods shall be listed components from the luminaire manufacturer and be specifically designed for the type of suspension called for on the Drawings. Installation shall be in accordance with the manufacturer’s instructions.

G. Recessed non-linear L.E.D. luminaires (i.e. downlights) located in lay-in type ceiling tile

shall be mounted in the center of the tile or as shown on the Drawings and shall be supported by means of bar hangers extended across the main ceiling support members and also supported from the building structure with no less than one (1) 1/4-inch threaded rod per luminaire. Where luminaires are installed in slopped ceilings the luminaires shall be complete with appropriate slopped ceiling adapters.

H. Surface mounted non-linear L.E.D. luminaires and exit lights shall be supported from the building structure with a minimum of two (2) 1/4 inch threaded rods per luminaire or exit light.

I. 1-1/2 inch x 1-1/2-inch steel framing channel shall be used where required to span bar joists and otherwise facilitate structural support for luminaires and exit lights.

J. Ceiling grid layouts when indicated on the electrical Drawings are for convenience only. This Contractor shall coordinate the luminaires layout with the Architect/Engineer and all other trades before the ceiling grid, air outlets, and luminaires are installed.

K. L.E.D. luminaires installed in mechanical room and other similar equipment rooms shall be located in the field to clear all obstructions such as ducts, piping, bracing, and supports. Where the location of luminaires shown on the Drawings must be radically changed, approval from the Architect/Engineer shall be obtained before the luminaire is placed.

L. Pendant mounted luminaires and exit lights shall be located to avoid mechanical systems, ductwork, piping, structural members, and the like.

M. Supports shall not terminate or be fastened directly to the roof decking.

II. GENERAL CONFORMANCE

A. Surface mounted luminaires shall not have gaps between the luminaire and attaching surface, except where required by code regulations or manufacturer’s instructions.

B. Recessed luminaires shall not have gaps between the luminaire trim and the adjacent surface. Where light leaks occur, suitable gaskets shall be furnished and installed.

C. Install luminaires level, plumb and true. Align rows accurately in three (3) dimensions.

D. Where luminaires are to be installed in areas without ceilings, this Contractor shall furnish supports consisting of threaded rods and steel channels as required to have a finished mounting height of 8’-0” to bottom of the luminaire (or other mounting height as shown on the Drawings), unless pendant or chain mounting is indicated on the Drawings or Luminaire Schedule.

E. Recessed luminaires shall be connected with flexible metal conduit or MC Cable (maximum 6’-0” length) from outlet boxes mounted above or alongside of luminaire. Luminaires shall be wired in such a way that removal of one shall not disrupt the continuity of power to the others.

F. All luminaires designated for wet locations shall have sealed conduit entries. Any luminaire leaking water before or during the warranty period shall be repaired or replaced by this Contractor at no additional expense to the Owner.

G. Prior to final inspection, this Contractor shall check all L.E.D. luminaires for damages during construction and replace the damaged luminaires where necessary at no additional expense to the Owner. All luminaires shall be cleaned at the time of final acceptance of the building.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include the materials and equipment necessary for this Contractor to furnish and install, a minimum of two (2), solar powered school zone warning signals, including a concrete base, where shown on the Drawings or where directed by the Owner, usually off site.

B. This Contractor shall furnish and install all necessary equipment and components as hereinafter detailed for a complete and functional signal.

III. QUALITY ASSURANCE

A. This Contractor shall furnish submittals for all components of the school zone warning signals in accordance with SECTION 260500 of these Specifications. The submittals should include, but not be limited to the following.

1. Manufacturer's catalog data for all equipment and components which shall include all technical data to demonstrate conformance with these Specifications.

2. Complete physical drawings of all items of equipment showing dimensions, metal gauges, etc.

3. Complete internal and interconnection wiring diagrams showing number, size, and types of conductors between components.

B. The school zone warning signals specified herein shall be the sole responsibility of a single supplier.

C. All work shall be in accordance with good engineering practices. All equipment for this system shall be listed by Underwriter's Laboratories, Inc. (UL), bear the UL label, and shall be installed in accordance with all requirements of the National Electrical Code (NEC), state and local codes, and these Specifications.

Part 2 - Products

I. SOLAR PANEL

A. Each school zone warning signal shall be furnished complete with solar panels as detailed on the Drawings. The solar panels shall consist of vandal resistant, ultra-violet stabilized, sixty (60) watt, silicon solar modules and glass laminated face with an aluminum backplate and an anodized aluminum frame. The solar modules shall have a peak output voltage of 16.5 volts DC under standard test conditions of 1000W/m2 at 25C.

B. Integral bypass diodes shall be included in each cell to allow the modules to produce power when partially shaded.

C. Minimum recovery time shall be three (3) hours in optimum sun conditions based upon five (5) hours of run time.

D. The solar panel shall have a minimum twenty (20) year output warranty.

E. The solar panel shall be complete with a weatherproof junction box providing wire termination for #14 AWG conductors.

II. BATTERY BANK

A. Each school zone warning signal shall be furnished complete with a battery bank. The battery bank shall consist of two (2) to four (4) Group 29 sealed maintenance free, deep cycle, gel lead acid type, 12VDC batteries (INTERSTATE Cat. No. SG29).

B. The batteries shall provide for a minimum of twelve (12) days of no sun operation based upon five (5) hours of operation at 78 degrees ambient cell temperature.

C. The batteries shall be housed in a separate pole mounted weatherproof NEMA 3R ventilated aluminum enclosure .125 inches thick complete with a gasketed door and a standard traffic/police type lock and continuous piano hinge. The enclosure shall be mounted to the pole as detailed on the Drawings.

III. CONTROLS

A. Each school zone warning signal shall be furnished complete with the following control electronics. All control electronics shall be mounted on a removable sub- assembly. The control electronics sub-assembly shall be fused for short circuit protection.

The sub-assembly shall include an eight-position labeled terminal strip accommodating spade-type connectors for the solar panel, battery, and beacon conductors.

B. The control sub-assembly shall include a programmable, solid state, seven (7) day time switch suitable for use on a solar school zone flasher with the following features:

1. Interface to the 12 VDC battery and to the school flasher shall be provided by means of an 8 pin octal base capable of terminating wire sizes up to #10

AWG.

2. The time switch shall operate on a nominal 12 VDC power source, and shall operate satisfactorily from -30 to +74 C.

3. The timing of the programmer shall be maintained by the 12 VDC battery and a back-up power source. Crystal accuracy of the programmer shall be +/- .005% throughout its full temperature range. No time shall be gained or lost during the replacement of the system battery.

4. Programming of the time switch shall be accomplished via a battery powered programmer designed for this function, or a laptop or desktop PC type computer. Upon completion of the program transfer from a programmer or PC computer to the time switch, an electronic check shall be activated to insure an accurate transfer of data. In the event an invalid transfer occurs, an error message shall be displayed on the programmer or the PC alerting the operator. The transfer cable connection shall be accessible from the front of the time switch, the programmer, and the PC.

5. Changeover from standard time to daylight savings time or vice versa shall be accomplished automatically. Leap year compensation shall be automatic.

6. The time switch shall be capable of initiating a minimum of 16 program steps. A program step is defined as the time of day and the day or days of the week at which the output relay shall be turned on or off.

7. The time switch shall have the capability of a pulsed output adjustable from 1 to 9 seconds in one second increments.

8. The time switch shall be capable of executing ten (10) separate skip plans programmable to any year in advance. Programming for the skip plans shall be accomplished through the use of the time switch programmer. Each plan shall be programmed by entering the beginning date (month/date/year) and the ending date for which the output of the time switch will not be activated. The time switch shall be capable of skipping as short a duration as one (1) day or as long as six (6) months. It shall be possible to begin a skip plan in one calendar year and end that same plan in the next consecutive year. It shall not be necessary to enter the skip plan program in chronological order.

9. A means shall be provided to maintain timekeeping and the program when the system power source (12 VDC battery) is not available. This back-up system shall maintain time keeping and all programmed steps intact for not less then 48 hours at 25C when fully charged, and shall go on line automatically upon removal of the 12 VDC battery. Upon reinstallation of the battery, the time switch shall automatically resume normal operation and begin recharging the back-up system. Should the program of the time switch be erased, the unit shall display an indication of the program loss. The display shall be a color coded LED. The device used for the back-up system shall be a rechargeable

capacitor. When the time switch is operating on the back-up system, the displays shall be blanked and the output disabled to conserve back-up power.

10. Integral with the time switch shall be three (3) LED indicators. A green LED shall flash when 12VDC power is supplied. This display will fast flash while the unit is receiving a program from a time switch programmer. An amber LED shall illuminate steady when the output relay is energized. A red LED shall illuminate when the back-up capacitor of the unit has discharged and the unit requires reprogramming.

11. The time switch shall have a single-pole, double-throw relay output with a contact rating of at least 10 amps at 120 VAC resistive load.

12. Field wiring shall be accommodated by an 8 pin octal base capable of terminating wire sizes up to #10 AWG. A separate terminal point on the octal base shall be provided for each pole of the relay, battery + and battery.

13. The time switch shall be RTC MANUFACTURING, INC. Cat. No. APT21TRDC only.

C. The control sub-assembly shall also include a solid state flasher/charge controller/regulator/low voltage disconnect module suitable for use in solar powered school zone warning signals with the following features.

1. The dual circuit flasher circuit shall provide fifty (50) to sixty (60) flashes per minute, fifty percent (50%) duty cycle.

2. The module shall regulate top end battery voltage with variances in temperature.

3. The module shall include low voltage disconnect deep discharge protection (11.2 VDC under load), automatic reconnect at 12.1 VDC, and shall include a "Low Battery" LED indicator.

4. The module shall include an automatic lamp intensity regulator to hold the lamp outlet constant with varying battery voltage.

5. The module shall include reverse current and on-board short circuit protection.

6. The module shall include a red charge rate LED.

7. The flasher unit shall be RTC MANUFACTURING, INC., Cat. No. DCF2 or approved equal.

D. The control electronics shall be housed in a separate pole mounted weatherproof NEMA 3R aluminum enclosure .125 inches thick complete with a gasketed door and a standard traffic/police type lock and continuous piano hinge. The enclosure shall be

mounted to the pole above the battery enclosure as detailed on the Drawings.

IV. SIGNAL BEACONS

A. The school zone warning signal shall be furnished complete with two (2) eight (8) inch diameter LED type signal beacons as detailed on the Drawings. Each signal beacon shall have: a one-piece aluminum body; one-piece aluminum cutaway visor attached at four (4) points to a one-piece aluminum door; terminal block, UL Type 1015, 600 volt, color coded wiring; and solid state LED amber lamp elements suitable for operation on 12 VDC as described below. The door shall have stainless steel hinge pins and thread lock hex-head screws. The signal beacons shall be the Maryland Department of Transportation (MDOT) Type VR-6 only.

B. The LED lamp elements shall be high efficiency, solid state amber LED lamps with a size of eight (8) inches. The lamp shall have optically matched LED elements for uniform color output of 590 nanometers. The amber elements shall contain LED elements constructed from TSAIInGaP. Lamps shall incorporate multiple main circuits comprised of four (4) LED's per string and shall be self- regulating with input voltages of 10.5 – 18.0 VDC. The lamp lens shall be either a clear or tinted UV stabilized acrylic which shall be easily removed and replaced. The lens of the lamps shall be designed to have up to 300 collector lenses for each LED with up to 450 exit facets to direct the light to meet a 17.5 degree vertical by 55 degree horizontal beam pattern.

V. SIGN FACE

A. Each school zone warning signal shall be furnished complete with one (1) sign face as detailed on the Drawings. The sign face shall be fabricated from .125 inch thick aluminum alloy conforming to ASTM B209, Alloy 5052-H38, 5154-H38, or 6061-T6. The background field shall be reflectorized. The message and borders shall be black. The sign face shall be pole mounted as detailed on the Drawings.

B. Sign faces are available free of charge from the Maryland Department of Transportation.

VI. POLE AND BASE

A. Each school zone warning signal shall be furnished complete with one (1) fifteen (15) foot high, 4-1/2" diameter, spun aluminum or .250 inch thick steel, schedule 40 pole as detailed on the Drawings. The pole shall be complete with a hot dipped galvanized finish.

B. The pole shall be complete with an eight-inch square, 3/4-inch thick base plate as detailed on the Drawings. The base plate shall be welded to the pole and shall be complete with four (4) 1-1/4 inch diameter anchor bolt holes meeting ASTM a- 36.

C. The pole shall be furnished complete with four (4) one (1) inch diameter by thirty- six (36) inch long hot dipped galvanized anchor bolts as detailed on the Drawings. The

anchor bolts shall have a minimum yield strength of 55,000 psi.

D. The pole shall be complete with a three (3) inch by five (5) inch hand hole with cover as detailed on the Drawings.

E. The pole shall be complete with four (4) breakaway support couplings as detailed on the Drawings. The couplings shall comply with AASHTO standards and shall be equal to ALCOA Model 100-1. A sheet metal skirt shall be installed around the couplings.

F. This Contractor shall provide a quick disconnect for each conductor passing through the pole base. The connector shall be the weatherproof "Y" type installed at the base.

Part 3 - Execution

I. INSTALLATION

A. This Contractor shall install the school zone warning signals in accordance with the Manual on Permits, Maryland Department of Transportation.

B. This Contractor shall assembly all components of the school zone warning signal in accordance with the manufacturer's/supplier's instructions.

C. The school zone warning signal shall be installed on a concrete base as detailed on the Drawings.

D. This Contractor shall be responsible for all damages to existing facilities, roadway, grass areas, sidewalks, etc. damaged during the installation of the school zone warning signals.

E. This Contractor shall furnish the Owner's officially designated representative with a minimum of eight (8) hours of on-the-job instructions in the operation, maintenance, and diagnostic testing of the system. This Contractor shall also furnish the Architect/Engineer four (4) bound copies of complete operating and maintenance instructions of the lighting control system including circuit diagrams and all other information necessary for proper operation and service maintenance.

II. SYSTEM TEST

A. This Contractor shall conduct an operating test of the completed school zone warning signal. Each signal shall test free from grounds, shorts, and other faults. All connections shall be thoroughly checked for mechanical and electrical connections. All control electronics shall be demonstrated to operate in accordance with the requirements set forth in these Specifications and as shown on the Drawings.

B. This Contractor shall perform all tests in the presence of the Architect/Engineer. This Contractor shall furnish all personnel and test instruments for use in the test.

III. WARRANTY

A. This Contractor shall deliver the work in a first-class operating condition in every respect.

B. This Contractor shall warrant that the material, equipment, and workmanship furnished shall be entirely free from defects, and shall repair or replace at this Contractor's own expense any material, equipment, or workmanship in which defects may develop before or during the warranty period. Refer to SECTION 01740 for the start of the warranty period. This Contractor shall further warrant that all material, equipment, and workmanship used in the installation, but not specifically mentioned in the Drawings and Specifications, shall be the best of their respective kinds and that the construction and installation shall be in accordance with the best accepted standard practices in all details.

C. All materials used shall be new and of good quality conforming to these Specifications. Any material not specified or reviewed by the Architect/Engineer that is incorporated in the work used or delivered to the site, shall be immediately removed upon the order of the Architect/Engineer and replaced to the satisfaction of the Architect/Engineer at this Contractor's expense.

D. If any work has not been installed in accordance with the Drawings, Specifications, or the manufacturer's instructions, or becomes damaged during the progress of the work, such materials or work shall, at the sole expense of this Contractor, be removed and replaced to the satisfaction of the Architect/Engineer together with any work disarranged by such alterations.

END OF SECTION

Part 1 - General

I. REQUIREMENT

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include the materials and equipment necessary for this Contractor to furnish and install the house and stage lighting control system, emergency lighting transfer system, stage theatrical lighting instruments, and stage lighting equipment herein specified. It shall also include the services of qualified field engineer/technicians regularly employed by the manufacturer of the system who shall review the installation to ensure its proper operation and provide Owner training.

B. The Auditorium Lighting Controls and Performance Lighting Systems shall be furnished by a factory authorized Theatrical Contractor/Distributor certified to design, program and service the systems. The Theatrical Contractor shall be responsible for coordination between the electrical installation and other trades installing theatrical equipment and for control terminations, system startup, system training, and warranty repair. A Theatrical Contractor is defined as a dealer who regularly engages in the sale and installation of theatrical supplies and equipment. The Theatrical Contractor/Distributor must show evidence of successfully furnishing theatrical systems specified for at least five (5) years.

C. This Contractor shall furnish and install all necessary equipment as hereinafter detailed for a complete and functional house and stage lighting control system including the stage theatrical lighting instruments. Although not every component is called out in every detail, it shall be the responsibility of the manufacturer providing the system to assure that the intended function is furnished.

D. The system specified herein shall consist of a dimmer-per-circuit high density dimming system equipment rack, performance lighting control console, E1.31 ANSI based network signal distribution system, distribution equipment, stage theatrical lighting instruments, and all required interconnecting wiring.

E. This Contractor shall furnish and install in accordance with the lighting control manufacturer's instructions, all conduits, wiring, and outlet boxes required for the erection and operation of the complete system(s) as herein specified and as shown on the Drawings.

F. The house and stage lighting control system shall be supplied as a single integral unit with all dimmer modules, control circuits, circuit breakers, and the like factory wired. Field wiring shall consist of connecting input feeders, dimmer circuits, and remote control wiring to the distribution devices and control console.

G. It is the intention of this specification section that the entire house and stage lighting control system be available to all bidders and not “Packaged or Bundled” with any other lighting systems or equipment.

III. QUALITY ASSURANCE

A. This Contractor shall furnish submittals for all components of the house and stage lighting and lighting control system in accordance with SECTION 16010 of these Specifications. The submittals should include, but not be limited to the following:

1. Manufacturer's catalog data for all lighting instruments, equipment, and components that shall include all technical data to demonstrate conformance with these Specifications.

2. Complete physical drawings of all items of equipment showing dimensions, metal gauges, etc.

3. Complete load schedules which shall clearly indicate actual connected loads and control channel assignment (where applicable), cross- reference of internal equipment identifications to circuit numbers shown on the Drawings, and all other scheduled information which shall relate the equipment to the project requirements. The schedules shall also clearly identify those circuits that are on the emergency lighting transfer system.

4. Complete internal and interconnection wiring diagrams showing number, size, and types of conductors between equipment and from equipment to loads, and feeder quantity and sizes.

B. All materials used shall be new and of good quality conforming to these specifications and the successfully reviewed submittals. Any material not successfully reviewed by the Architect/Engineer that is incorporated in the work, used or delivered to the site, shall be immediately removed upon the order of the Owner or Architect/Engineer and replaced to the satisfaction of the Owner and Architect/Engineer at this Contractor's expense.

1. It shall be this Contractor’s responsibility to include costs incurred in other trades for any work disarranged by such replacements described above. This will include replacement of work and damaged equipment during the progress of construction.

C. The lighting control system equipment specified herein shall be the sole responsibility of a single manufacturer. The manufacturer shall have been producing theatrical lighting and SCR type lighting control systems for at least fifteen (15) years.

D. All work shall be in accordance with good engineering practices. All equipment for this system shall be listed by Underwriter's Laboratories, Inc. (UL), bear the UL label, and shall be installed in accordance with all requirements of the National Electrical Code (NEC), state and local codes, and these Specifications.

E. The entire house and stage lighting control system shall be completely factory assembled and tested under load conditions prior to shipment of the system.

F. Existing Systems Only: Prior to any work being performed on the existing system, the entire house and stage lighting control systems shall be completely tested under load conditions. The test shall include each device on the existing system. The Contractor

shall certify the operating condition and report any abnormal conditions to the Owner.

IV. QUALIFICATIONS

A. The Contractor and the Theatrical Contractor/Distributor shall be required to furnish satisfactory proof of their competence as evidenced by successfully completed previous contracts where control equipment of this nature has been specified.

B. The Contractor is encouraged to visit the site, become familiar with the Drawings outlining this work, and shall become completely familiar with the various items of equipment being furnished under other Divisions of these Specifications related to this work. This Contractor shall make all necessary investigations relative to the conditions that may be encountered on this project.

V. SPARE PARTS

A. This Contractor shall furnish to the Owner spare parts as follows. Spare parts shall be furnished prior to the installation of the system.

1. Two (2) dual 2.4 kW dimmer modules.

2. One (1) spare dimmer rack processor. (Control Modules)

3. One (1) Spare Architectural Processor

B. This Contractor shall furnish to the Owner, at the completion of the project, 20% (minimum of two) spare lamps for each type and wattage of lamps used in the theatrical lighting instruments and the dimmable house luminaires.

Part 2 - Products

I. MANUFACTURERS

A. The house and stage lighting control system as shown on the Drawings and herein specified shall be as manufactured by ELECTRONIC THEATRE CONTROLS, INC. (ETC) [Sensor3™ System] as listed or the equivalent as manufactured by STRAND LIGHTING, INC. [C21 System] which must meet all of the requirements of these Specifications. The system shall utilize the manufacturer's standard products and components with modifications as required meeting the construction and performance requirements of this section.

B. The theatrical lighting instruments as shown on the drawings and herein specified shall be as manufactured by ELECTRONIC THEATER CONTROLS INC. (ETC), and STRONG ENTERTAINMENT LIGHTING (followspots) as listed or the equivalents as manufactured by STRAND LIGHTING, INC., ALTMAN or LYCIAN (followspots) which must meet all of the construction and performance requirements of these specifications.

II. DIMMING SYSTEM EQUIPMENT RACK

A. This Contractor shall furnish and install where shown on the Drawings, a house and stage lighting dimming system equipment rack(s). The racks shall be the ETC Sensor3

SR3-48 (48 module) Advanced Features dimmer rack.

B. Dimmer Rack Electrical:

1. The dimming system equipment rack shall be suitable for operation at 120/208 volt, three phase, four wire, + ground, sixty hertz, 800 amp, and have busing rated for 100% continuous duty, and suitable lugs for a single point connection. Sensor racks shall automatically compensate for frequency variations during operation. Standard SCCR fault current protection shall be 100,000A. The rack shall have a bus kit provided by the manufacturer to allow adjacent racks to be powered by a single feed. Racks shall be UL listed with appropriate factory applied labels.

2. Load and neutral terminals shall be sized to accept up to three (3) sets of 500 kcmil conductors or other sizes and/or quantities as shown on the Drawings.

3. Load terminals shall be located at the front of the wiring cavity. Front access racks having terminals located at the back of the rack or on the side near the back of the rack such that adjacent load cabling may block terminal access shall not be acceptable.

C. Dimmer Rack Electronics:

1. Power control electronics (CEM3) shall be contained in a single module that must be plug-in capable without use of tools.

2. All data and power input for CEM3 control electronics shall be located on a separately removable/pluggable termination connector on the backplane such that backplane can be replaced without removal and discrete secondary conductor terminations. Dimming systems that require discrete termination of DMX, Ethernet, power input, and dimmer control output directly on terminals on the control module or pluggable backplane shall not be permitted.

3. The power controller shall directly support the following network protocols:

a) Net3 protocol suite including ANSI E1.31 Streaming ACN (sACN)

b) ANSI E1.17 Architecture for Control Networks (ACN)

4. Systems must support the above listed industry standard ACN protocols for Ethernet setup, control and feedback integrated directly between the power system and control system.

5. The power controller shall directly support 2 ports of control input using ANSI E1.11 USITT DMX512-A.

6. Dimming control signals must be sent between control module and dimmer/power modules using flat ribbon cables.

7. System must provide an optional low voltage connection to maintain power of control electronics through brown out, instantaneous, and sustained power

outages.

8. Control electronics shall be housed in a formed steel body with cast- aluminum face panel.

D. Physical:

1. The Sensor3 dimmer rack shall be a free-standing, dead-front switchboard, substantially framed and enclosed with 16 gauge, formed steel panels. All rack components shall be properly treated, primed and finished. Exterior surfaces shall be finished in fine-texture, scratch- resistant, gray epoxy paint. Removable top and bottom panels shall facilitate conduit termination on the rack.

2. Rack components shall be designed for easy removal and installation so that the dimming system equipment rack is completely open and empty during field wiring. Rear access to the rack for installation or servicing shall not be required. Racks shall be designed for front access to allow back-to-back, back-to-wall or side-by-side installation.

3. Racks shall be designed to allow easy insertion and removal of all modules without the use of tools. Supports shall be provided for precise alignment of dimmer modules into power and signal connector blocks. With modules removed, racks must provide clear front access to all load, neutral and control terminations.

4. Module spaces shall be mechanically keyed to accept only the 3kW or below, 5kW, or 10kW module specified for that space. The rack shall be configurable to accept mixed dimmer types and sizes throughout the rack.

5. Each rack shall provide a lockable full-height door containing an integral electrostatic air filter that shall be removable for easy cleaning. A single low-noise fan shall be located at the top of each rack. Design of the rack and dimmer modules shall draw all cool air intake air through the integral electrostatic air filter at the front of the rack, discretely through each module housing and directly out the top of the rack such that exhausted hot air from adjacent modules does not heat the module(s) above, below, or to the side of each other.

6. The fan shall maintain the temperature of all components at proper operating levels with dimmers under full load, provided the ambient temperature of the dimmer room does not exceed 40°C/104°F. Dimmer racks that do not employ both locking doors and electrostatic air filters shall not be acceptable.

7. The fan shall turn on whenever any dimmer in the system is activated. In the event of an over-temperature condition, only the affected dimmer module(s) shall shut down and a message shall appear on the control module LCD. The fan shall remain on during thermal shutdown of individual dimmer modules. Systems must include over-temperature sensing and preventative thermal shutdown.

8. A fan sensor shall be provided. In the event of momentary fan failure, error

message will be displayed and sent remotely over Ethernet to optional logging systems. Systems must provide optional system event logging.

9. If the ambient room temperature drops below 0°C/32°F or rises above 40°C/104°F, a warning shall appear on the dimmer rack LCD. If the temperature rises above 46°C/115°F, the rack shall shut down until the condition is corrected.

10. A 3 x 0.5-inch LED status indicator (beacon) shall be mounted in the rack door. The beacon shall be visible throughout a wide viewing angle. In normal operating conditions, this LED is illuminated. If the rack's control module senses an error condition, the beacon shall flash until the error is corrected. An optional indicator shall be available for remote locations. Racks must have external means of visually showing that an error is present.

E. Provide two (2) SR3AF 48 Advanced Features Dimmer racks (7141A1005) with all applicable cross bussing hardware. [Engineer; edit for quantity of racks]

F. Provide an engraved nameplate on the front face of the dimmer rack in a suitable location. The nameplate shall be lettered HOUSE AND STAGE LIGHTING THEATRICAL DIMMING SYSTEM EQUIPMENT RACK.

III. POWER CONTROL ELECTRONICS

A. The dimmer rack electronics shall be contained in one plug-in CEM3 Power Controller. Each power controller shall plug into the dimming cabinet with no need for tools or discrete wire connections. A simple user interface shall be provided for group configuration, testing and diagnostics. Power control shall be UL/cUL Listed and CE Marked. Removal of Power and Dimming Control electronics must be a tool free process.

1. The control electronics shall be contained in one plug-in module, housed in a formed steel body with cast-aluminum face panel, and self-retaining ejection handles to ease removal from the rack.

2. The power control shall automatically compensate for frequency variations during operation.

B. Power Control Interface:

1. A backlit eight-line by 20-character graphical LCD shall be provided for system configuration, live control, and status display.

2. The following functional features shall be available in power control to reduce setup and tech times:

a) Full number pad shall be provided for quick access to dimmers. Power Control must provide 0-9 number pad and logic keys for AND, THRU, and AT for fast access, selection, and control of circuit/dimmer number.

b) Power control shall provide NEXT and LAST buttons to progress

through circuits/dimmers during dimmer check operations such that only a single circuit is brought on to a level at a time during pre-show lighting checks for lamp burnouts.

c) Shortcut buttons for Setup, About, and live control shall be provided for separation of functionality such that a user intending to check status or settings does not accidentally render their system unusable. These buttons shall also serve to reduce maximum time to access any feature or setting on a single dimmer, range of dimmers, or entire rack.

3. The front panel shall have five status LED indicators: power, network activity, DMX A, DMX B, and panic state.

4. Power control must include the above buttons and features.

C. Control Signal and Communications:

1. The power control shall be provided with an Ethernet control signal input. This input shall be fully configurable with a range of patching and priority programming capabilities. The Ethernet signal shall supply seamless integration between the dimmer racks and both the entertainment and architectural lighting control systems. The Ethernet signal shall also enable remote configuration, playback, file storage and monitoring features on a personal computer on the network. Dimming systems that require Ethernet to DMX translation devices for control of critical show lighting introduce a potential failure point and shall not be acceptable.

2. All data and power input for CEM3 control electronics shall be located on a separately removable/pluggable termination connector on the backplane such that the backplane can be replaced without removal and discrete secondary conductor terminations. Systems must support tool- less and not require removal of wires connected directly to the control electronics.

3. DMX connections shall be available with option for pluggable screw or punch-down type terminal. Systems must allow this option to support both DMX over CAT5 and multi-strand conductors.

4. Ethernet connection shall be available via standard Cat5 RJ45 connection. System requiring punch down direct to rack or controller cannot be Cat5 system certified and shall not be acceptable.

5. Dimming systems that require discrete termination of DMX, Ethernet, power input, and dimmer control output directly on terminals on the power control or pluggable backplane shall not be acceptable.

6. The following options shall be provided to backup all controller setup UL924 Panic configuration, and recorded presets:

a) Automatic backup in non-volatile backplane memory.

b) Automatic backup in non-volatile Controller memory.

c) USB storage device pluggable on the controller face panel.

d) Data shall also be transferable to and from library storage on a personal computer on a per-rack basis.

7. The power controller shall directly support the following network protocols:

a) Net3 protocol suite including ANSI E1.31 Streaming ACN (sACN).

b) ANSI E1.17 Architecture for Control Networks (ACN).

8. The power control shall directly support two (2) optically isolated ports of ANSI E1.11 USITT DMX512-A for control input. Minimum 2,500V of optical isolation shall be provided between the DMX512 inputs and the electronics. Systems having optical isolation on a prewired factory plug-in device shall not be acceptable.

9. Systems must support the above listed industry standard ACN protocols for Ethernet setup, control, and feedback integrated directly between the power system and control system.

D. Power Control Features

1. Power Control shall have a dimmer update rate better than 16ms (60HZ) or 20 MS (50 Hz) average. Dimmer outputs shall exhibit no oscillating or hunting for levels. Dimmers with the same choke type set to the same level shall output within ±1V of each other, regardless of phase or input voltage.

2. Power control shall maintain proper dimming performance for all line feed frequencies from 47-53Hz and 57-63Hz without flicker or misfire. Shifts in frequencies up to 3 Hz shall not result in flicker or loss of dimming timing. Systems must perform to these frequency tolerances and shifts.

3. Dimmer output levels shall be regulated for incoming line voltages. The regulation shall adjust for both RMS voltage changes and deformations in the incoming AC waveform. The power control shall monitor and adjust each dimmer's output to maintain a constant power to the load. Regulation shall maintain the desired output voltage ±1V for the entire operating range (91-139V and 181-259 VACS) with the exception that the maximum output will be no greater than the line voltage minus dimmer insulation loss. The regulation shall compensate for dips and anomalies in the AC waveform on a dimmer by dimmer basis. There shall be no interaction between dimmers in the system or any other equipment. The output shall be nominally regulated to 115V/230V appropriate for the market, but shall be field adjustable on a dimmer by dimmer basis to allow for varying cable length. Systems must maintain performance to the above stated voltage regulation.

4. Power control shall support a rack filled with different types and sizes of dimmer modules. The properties of each dimmer shall be configurable, including dimmer name, output curve, dimmer firing mode, and scale voltage values.

a) The output curve selections shall include IES Modified Square, Square, Linear, Modified Linear and a Sensor v2.0 output curve. The power control shall also have the capability of storing up to three custom curves as well as an adjustable preheat level, assignable on a per-dimmer basis.

b) The dimmer firing modes shall include: Normal (Dimmed), Dimmer Doubled, Switched (unregulated on/off with adjustable on-at level), Fluorescent with adjustable threshold, and Off.

c) Dimmers set as Dimmer Doubled shall allow a single dimmer to set two different levels on one dimmer circuit by splitting the AC power into positive and negative half cycles with no resultant DC line current.

d) Power Control must support all above listed adjustments to dimmers on a per circuit basis.

5. Controller shall support two (2) methods of automatic configuration during controller replacement in a rack.

   a) Use backplane configuration- The backplane shall retain full setup and preset data in. In this recovery mode, when a new power control is inserted, the controller shall automatically come on-line fully functional without any manual intervention.

   b) Use controller configuration- Override backplane configuration such that replacement modules automatically use the configuration resident in nonvolatile memory of the power control.

6. Controller shall be capable of changing rack setup for multiple shows for an entire system with a single update command from a remote PC. Show setup shall be saved in XML format and capable of being saved/uploaded from both USB and remote PC.

7. In the event of data loss each rack shall maintain the last level for a user programmable time of zero to five minutes or indefinitely, or may be programmed to fade out or to play a specific preset. Systems must offer this feature.

8. The power control shall contain diagnostic routines to allow the user to test and troubleshoot the system. The power control shall also contain a Test/Bypass switch to turn all dimmers on to full for testing. This switch shall bypass all electronics and shall force the fan on. Systems must include local control, “all on” control bypass, and diagnostic routines.

9. The power control shall be able to record up to 64 presets in a rack. Presets shall be user programmable by recording a snapshot of current dimmer levels (as set by the all control sources), by entering dimmer levels on the power control directly, or a combination of both methods. The system shall have the ability to program and activate group wide presets from the power control,

remote station, console, networked computer, or handheld device. Presets shall be activated in the default fade time of 2 seconds, but shall be have a user-programmable fade time between 0 and 60 minutes.

10. A system wide panic (emergency UL924) activation circuit shall be provided. Any dimmer in any rack may be assigned to the panic circuit. The panic shall be set to a maintained closure. Upon activation the system shall:

    a) Force all circuits selected to be included in panic to a master level between 80-100%

    b) Optionally force all non-panic dimmers to zero

    c) Provide configurable fade time to and from “emergency” state

    d) Provide configurable delay to and from “emergency” state

11. DMX A and B as well as the Ethernet DMX (EDMX) data may be patched using a rack start address - assigned sequentially from a starting control channel or patched individually on a per-dimmer basis. Priority may be set per universe for the DMX inputs, and set per universe by the control source for Ethernet input. Each dimmer may have up to six network control inputs with either a highest takes precedence or priority patch. Each dimmer may also then be assigned to one of 16 spaces for additional specific preset control. Each preset shall have a separate priority for maximum flexibility of prioritization. Systems that must support prioritization of multiple Ethernet sources beyond HTP shall not be deemed acceptable. Systems must support the above listed flexibility in control source prioritization shall not be deemed acceptable.

12. Power control shall provide the ability to set a single circuit, all circuits or a range of circuits to a level at the control interface in the rack. Systems that cannot locally control dimmers through local control override shall not be acceptable.

13. The power control shall be capable of monitoring and displaying incoming line voltage for all three phases on the LCD. With installed current sensors, the same display shall show amperage on each phase.

14. The power control shall support security protected access. The user shall to able to program passwords that restrict access, preventing unauthorized use of higher-level functions by unauthorized personnel. Systems that do not provide security protected access to features that can render the system unusable shall not be acceptable.

E. Standard Feedback:

    1. System and Rack messages shall include, but not be limited to, the following:

        a) DMX port A or B has an error or has failed

        b) Network has an error or has failed

c) Phase A, B or C is below 90 volts

d) Phase A, B or C is above 140 volts

e) Phase A, B or C did not start because it was below 90V or above 140V at power up

f) Phase A, B or C voltage headroom warning

g) Frequency is not 50 or 60 Hz

h) Rack shutting down due to air flow loss

i) Ambient temperature is below 0°C/32°F

j) Ambient temperature is above 40°C/104°F

k) Rack shutting down - ambient temperature exceeds 46°C/115°F

l) Configuration memory error

2. About display shall allow monitoring of system, rack or dimmer status.

a) About System shall provide information about Panic circuits, Preset looks, and System name.

b) About Network shall provide IP address, gateway and net mask.

c) About Rack shall provide information about rack name, ambient temperature, air filters and rack type.

d) About Rack Power shall provide information about power type, rack voltages, current per phase (only with current transformers), under voltage warnings.

e) About Rack Data shall provide status for DMXA, DMXB, EDMX and Network activity.

f) About Dimmer shall provide information about dimmer type, location, output level, control source, scale voltage, mode and curve.

F. Advanced Feedback:

1. Sensor's Advanced Features (AF) shall provide an additional sensor in the individual dimmer modules. This must allow monitoring of current and output voltage on a dimmer by dimmer basis and provide information on lamp burnouts, dimmer status, and input voltages.

2. Power control shall allow the user to record the loads of all AF dimmers in the system. The power control shall, during operation, test each AF dimmer,

determine its load, and compare it to the recorded load. Any change from recorded loads of configured tolerance shall display an error on the power control and any monitoring device on the network. If a dimmer is driven on with no load, an optional message shall be available to notify the console operator and electrician that there is no load.

3. Dimmer Specific messages shall include, but not be limited to, the following:

    a) Load has dropped below recorded value

    b) Load has raised above recorded value

    c) DC detected on dimmer output

    d) One SCR has failed on/off

    e) Dimmer has failed off or circuit breaker has tripped

    f) Dimmer has been removed

    g) Dimmer load has failed

    h) Dimmer has shut down due to over temperature

    i) About Dimmer display shall provide additional information regarding the dimmer's recorded load and current or actual load

4. System shall offer a reporting feature of power load and consumption per individual load

G. Network Interface:

1. The Ethernet network shall provide an integral link to connect all racks in the system for rack-to-console and rack-to-network device communication.

2. The network interface to the power controller shall provide a number of user-programmable control schemes between control sources, including architectural control.

3. Hardware settings for rack type, available module types, availability of AF features, and operating voltage shall be configurable at the factory or in the field, and shall not require secondary setup after system commissioning even in the event to power controller replacement.

4. User programmable parameters shall support onsite setup, via the local interface in the rack. These parameters shall include, but not be limited to, defining module type, scale voltage for each dimmer, firing mode, curve, dimmer numbering and DMX512 or network port assignments. Systems requiring factory programming shall not be acceptable.

H. Provide one (1) CEM3 control module (7140A1001) per dimmer rack with one (1) additional CEM3 module (spare) for the system.

IV. CONTROL ENCLOSURES

A. The Control Enclosure shall be the Unison ERn Series Control Enclosure as manufactured by Electronic Theatre Controls, Inc., or equal.

B. Mechanical:

1. The ERn Control Enclosure shall be a surface mounted panel, suitable for rack mounting, constructed of 18 gauge formed steel panels with a hinged, lockable full-height door containing an integral electrostatic air filter.

    a) The Enclosure door shall have an opening to allow limited access to the control module face panel.

    b) Enclosures shall be convection cooled without the use of fans.

    c) Enclosure shall be have rack mounting brackets.

2. Control Enclosures shall be sized to accept one or two Control Processors and one or two Station Power Modules, as needed for a complete system, including various options and accessories.

    a) The two-space Control Enclosure (ERn2) shall support a single Station Power Supply module.

    b) The four-space Control Enclosure (ERn4) shall support two Control Processors, and two Station Power Supply modules, or, one Control Processor, one Station Power Supply Module and one Station Bus Repeaters module, or one control processor and one dual Station Bus Dual Repeater module.

3. All Enclosure components shall be properly treated and finished.

    a) Exterior surfaces shall be finished in fine textured, scratch resistant, powder based epoxy paint.

4. Enclosure(s) shall be the 19” rack mounted (RM) version.

    a) Rack-mounted version shall have an independent Enclosure suspension kit, with a full height, locking door/cover attached to the kit.

    b) Rack-mounted version shall have an opening to access the control module face panel, and openings to view indicators on option modules.

    c) Rack-mounted version enclosure dimensions and weights (without modules) shall not exceed ERn2-RM - 19" W 11"H 10" D, 20 lb.

5. Top, bottom, and side knockouts shall facilitate conduit entry.

6. Enclosures shall be designed to allow easy insertion and removal of all control and option modules without the use of tools.

    a) Supports shall be provided for precise alignment of modules into power and signal connector blocks.

    b) With modules removed, Enclosures shall provide clear front access to all power and control wire terminations.

C. Electrical:

1. Control Enclosures shall have 120 volt, single-phase configurations.

2. Control Enclosures shall be completely pre-wired by the manufacturer. This contractor shall provide input and control wiring.

3. Control Enclosures shall be designed to support the following wire terminations:

    a) AC (single phase)

    b) Echelon link power (Belden 8471 or equivalent)

    c) 24Vdc (2- 16AWG Wire)

    d) DMX512A Port A (In or Out) (Belden 9729 or equivalent)

    e) DMX512A Port B (In or Out) (Belden 9729 or equivalent)

    f) RS232 Serial In/Out (Belden 9729 or equivalent)

    g) Unshielded Twisted Pair (UTP) Category 5 Ethernet

    h) Contact Closure In (14AWG to 26AWG Wire)

    i) Contact Closure Out (14AWG to 26AWG Wire)

        (1) Contact Closure Out shall provide 1A @ 30vDC

4. Station Power Modules

    a) Station power supply modules shall provide LinkPower for at 32 stations and 1.5A@24VDC of Auxiliary (AUX) power.

    b) Station power module shall support over-current/short protection for LinkPower and Aux. LinkPower shall support fault detection on each leg of the balanced data bus.

5. All control wire connections shall be terminated via factory provided connectors.

D. Thermal

1. Ambient room temperature: 0-40°C / 32-104°F

2. Ambient humidity: 30-90% non-condensing

E. Provide one (1) Unison ERn Series Control Enclosure

V. CONTROL PROCESSOR MODULES

A. The Architectural Control Processor shall be the Unison Paradigm P-ACP Series Control Processor as manufactured by Electronic Theatre Controls, Inc., or equal.

B. The Architectural Control Processor (ACP) assembly shall be designed for use in DRd Series Dimming Enclosures and ERn Series Control Enclosures.

C. The processor shall utilize microprocessor based, solid state technology to provide multi-scene lighting and building control.

1. ACP shall support functions such as station programming, macro sequencing, electronic lockout, room combine and astronomical time clock events. ACP station processor shall allow configuration of the control system via the menus.

2. When used in a dimming enclosure, the ACP shall allow access to dimming control menus including the status screen, dimming configuration screen, backup menu, test menu and configuration menu.

D. One ACP shall be rated to drive 1024 channels of control, 1024 zones, 64 rooms, 512 presets, 62 button or button/fader stations and 6 Touchscreen Stations.

E. ACP module electronics shall be convection cooled.

F. The ACP shall provide front-panel RJ45 jack, Secure Digital (SD) card slot, and Universal Serial Bus (USB) Port for configuration and data exchange.

G. Architectural Lighting System configuration and program information shall be stored in flash memory, which does not require battery backup.

H. The ACP shall be contained in a plug-in assembly and require no discrete wiring connections; all wiring shall be terminated into Dimming or Control Enclosure.

1. The ACP shall support the following communications:

a) Echelon LinkPower

b) 10/100BaseTX, auto MDI/MDIX, 802.3af compliant Ethernet networking with TCP/IP, ESTA BSR E1.17 Advanced Control Networks (ACN) and ESTA BSR E1.31 (sACN) Protocols

c) EIA-232 serial protocol

d) ESTA DMX512A, configurable as input or output ports

e) Dry contact closure inputs

f) Dry contact closure outputs, rated at 1A@30VDC

I. Provide one (1) Paradigm Architectural Control Processor (7180A1001) and one (1) spare P-ACP

VI. DIMMER MODULES

A. The dimmer modules shall be the Sensor Advanced Features modules as manufactured by Electronic Theatre Controls, Inc., or equal. Sensor Modules shall be designed for complete flexibility of choice for dimmed, non-dim, or hot power on each 20A branch circuit. A single module shall provide one of the following:

1. Two dimmed outputs with choice of 500 or 350us rise times, controlled by DMX.

2. Two air gap relay switched outputs controlled by DMX.

3. Two manual bypass constant power circuits, controlled manually.

a) The module may be configured to operate as two dimmers, two relays, or any combination of relay and dimmer from the CEM3 Power Control Module or from an ETC control console connected to a CEM3 system. Any single circuit may be set to bypass the dimmer using a switch on the front of the module.

4. The power control system shall report circuit specific errors via the rack control electronics and/or via a lighting control console.

5. Modules shall provide the following status reporting functions:

a) Load dropped below recorded value

b) Load increased over recorded value

c) DC on dimmer output

d) SCR failed on/off

e) Circuit breaker tripped

f) Dimmer error

g) Module removed

h) Load absent

B. Electrical:

1. Each dimmer module shall contain two single-pole circuit breakers, a solid-state switching or dimming module, associated toroidal filters, power and control connectors, a 120VAC remotely controllable mechanically latching air gap relay, a low voltage dc manual bypass override switch, and one fuse per branch circuit for sufficient short circuit rating.

2. Modules shall not have any protruding pins subject to physical damage when the module is not installed.

3. Modules shall be keyed so that dimmer modules of different capacity shall not be interchangeable.

4. Each dimmer shall be protected by a fully magnetic single pole, 20 amp, or as shown on the Drawings, one hundred percent (100%) rated circuit breaker listed at 10,000 amps or greater interruptible current mounted on the face plate of the dimmer. The breaker shall be used as a dimmer disconnect and shall be rated for 100% switching duty. Circuit breakers shall be rated for tungsten loads having an inrush rating of no less than 20 times normal current. Under overload conditions, the circuit breaker shall disconnect power to the dimmer module before damage can be done to the power devices. The trip current shall not be affected by ambient temperature within the operational specifications of the system. Dimmers must operate continuously at 100% load.

5. Modules that use Triac dimming shall not be acceptable. Modules which utilize an SCR or Triac solid state switch as a dimmer bypass may void warranty of products they are powering and shall not be an acceptable means of bypass.

C. SCR Assembly:

1. Each dimmer shall be rated 2.4kW.

2. Each dimmer module shall use a solid-state module (SSM) consisting of two silicon-controlled rectifiers (SCRs) in an inverse parallel configuration, and all required gating circuitry on the high voltage side of an integral, opto-coupled control voltage isolator. Rectifiers, copper leads and a ceramic substrate shall be reflow soldered to an integral heat sink for maximum heat dissipation. The SSM shall also contain a control LED, a thermistor for temperature sensing, and silver-plated control and load contacts. The SSM shall include an integral output LED, output voltage sensors and current sensors for feedback to the control module. The SSM shall provide a parallel output connection which completely bypasses all SCR dimming including toroid filters and shall intercept the output prior to connection of the load sensing circuit such that the advanced features are still active during bypass. The entire SSM shall be sealed in a plastic housing requiring only a screwdriver to replace. Dimmers must employ triac power devices, pulse transformers, or other isolating devices providing at least 2,500V RMS isolation. Dimmer modules requiring disassembly, heat sink grease or additional tools for repair shall not be acceptable.

3. All electronic components (current/voltage sensors and indicators) shall be contained in a single, field-replaceable housing. Modules requiring discrete wiring of electronic components shall not be acceptable.

4. SCR power switching devices shall have the following minimum ratings:

Module Size:	20A
Single cycle: Peak surge current	625A
Half cycle: 12T	1,620
Transient over voltage	600V
Die size (in)	.257

D. Filtering:

1. Dimmer modules shall include toroidal filters to reduce the rate of current rise time resulting from switching the SCRs. The filter shall limit objectionable harmonics, reduce lamp filament sing and limit radio frequency interference on line and load conductors. Modules shall offer 350 or 500 uS, filter rise times. Rise time shall be measured at the worst case slew rate (about 50 percent) from 10 to 90 percent of the output wave form with the dimmer operating at full load.

2. All dimmers shall maintain their published rise time and/or fall time regardless of duty cycle or rack temperatures. Dimmers that de-rate due to increased dimmer temperature caused by full load operation or high phase angles shall not be acceptable.

E. Power efficiency for standard dimmers shall be at least 97 percent at full load with a no-load loss of 3V RMS. The dimmer shall accept hot patching of a cold incandescent load up to the full rated capacity of the dimmer.

F. Dimmer modules shall be fully plug-in and factory wired. Dimmer modules shall consist of a heavy duty, die-cast aluminum chassis with integral face panel. No tools shall be required for module removal and insertion. All parts shall be properly treated, primed and finished in fine-texture, scratch resistant, gray epoxy powder coat. With the exception of the circuit breaker, the module shall contain no moving parts. Each module shall be labeled with the manufacturer's name, catalog number and rating. Modules constructed of molded plastic for structural support are not equivalent and are not acceptable. Modules shall be UL Recognized.

G. Provide seventy-three (73) D20AFTR Advanced Features Thru Power Dimmer Modules (7083A1022) and twenty-three (23) AFM Air Flow Modules.

H. If manufacturer is unable to provide a Thru Power Module, manufacturer shall provide ten (10) spare relay modules (in addition to the dimmer modules) and five (5) spare Constant Circuit Modules.

VII. GENERAL NETWORK

A. The Electronic Theatre Controls (ETC) Net3 network shall provide data distribution over TCP/IP Ethernet networks. Data shall be layer 3 routable. Systems using proprietary formats or formats other than 10/100/100Mbit wired Ethernet or non-layer 3 routable networks shall not be accepted.

1. Connections shall be made between consoles, face panels, architectural processors, dimmers, Net3 Gateways, and computers over standard Ethernet distribution systems using 100BaseT, 100BaseFL, or greater wiring. All installations shall conform to established Ethernet wiring practice, and installation shall be performed by contractors qualified to do this type of work. All wiring shall be tested at Category 5e or higher for full bandwidth operation to the appropriate IEEE standard.

2. The Lighting Control system must be supplied by a single manufacturer and must have seamless integration over Ethernet between the Performance and Architectural lighting control.

3. Network data, DMX associated equipment, and theatrical control devices shall be housed in a separate wall mounted equipment rack.

B. Capacities:

1. The network shall support DMX routing, patching, and prioritization for up to 63,399 universes (32,767,488 DMX addresses). Each address may be input or output from any port on any DMX gateway in the system. DMX input, routing and output shall be specifically supported on the system from multiple sources and locations up to the maximum number of gateways supported by the Ethernet topology.

2. The network shall support multiple network hosts including consoles, gateways, dimming racks, computers, file servers, printers, and architectural control processors with discrete command lines and control. The lighting network shall support multiple venues within a system and discrete systems on the same network.

C. System Configuration and Monitoring:

1. Network device configuration shall be via Net3 Gateway Configuration Editor (GCE) software and/or ANSI E1.17 Architecture for Control Networks (ACN).

2. Patch addresses shall support viewing and manipulation via ANSI E1.17 ACN.

a) The system shall permit complete user flexibility allowing the system operator to patch each DMX input address to any ANSI E1.31 streaming ACN address, and DMX output to span streaming ACN universes.

b) The lighting system shall support assignment of DMX offsets, truncation of DMX universes, and provide choice of DMX port prioritization.

c) The lighting system shall support the DD start code extension to ANSI E1.31 which provides priority per address such that multiple control sources can share universes with discrete control per address.

d) Lighting systems that must support the above-mentioned address patching capabilities

3. The system shall allow assignable labels for all network devices to allow easy identification by system users.

4. Each network device shall have a discrete and unique IP address provided automatically by the software. The user may edit this IP address. Systems that must support automated IP allocation with IP collision avoidance, and systems that do not allow complete reconfiguration of the above-mentioned features over ANSI E1.17 ACN shall not be acceptable.

5. All configuration data for each network device shall be held at the device and system operation shall not require continuous on-line operation of the network configuration software.

6. Lighting console operators shall be able to back up the network configurations in the lighting control console. In the event of a network device failure, the operator shall be able to apply the configuration of the failed device to a replacement device of the same type without manually reentering settings. Systems that must support configuration backup as described above.

7. Architectural and Entertainment systems connected to the same network shall be capable of arbitrating control over E1.31 Streaming ACN (sACN) level data. The system shall be capable of alternating control of individual address data between architectural and entertainment systems without intervention by the user. The user shall dictate the conditions under which system shall automatically take control. The network shall allow user override of the selected defaults. Systems which require direct user intervention to allocate control of dimmers between architectural and entertainment lighting systems shall not be accepted.

8. The Net3 network shall allow multiple DMX input sources to be prioritized on the same universe as network native sources using E1.31 Streaming ACN prioritization. Multiple DMX inputs may be assigned to the same streaming ACN address (this provides multi-source control for a particular address). Likewise, the system shall support E1.31 prioritization of multiple simultaneous network sources. Systems that cannot prioritize multiple DMX inputs and multiple native network sources on a network shall not be deemed suitable.

9. The lighting network shall allow each DMX input address to be assigned a priority on the network allowing each DMX control level coming into the system to participate in full arbitration. Addresses with the highest priority shall have control, with lower priority addresses being ignored. Addresses assigned the same numeric priority, between 1 and 200, shall respond in highest level takes precedence (HTP) manor. The network shall require a valid DMX signal present at the input to initiate prioritization. Systems that do not allow for prioritized HTP

for DMX inputs to the network shall not be allowed.

VIII. Operational Features:

1. Each DMX gateway shall control up to 512 DMX addresses per port, within the confines of up to 63,999 DMX universes (32,747,488 address). The specific DMX data input or output by the gateway shall be configurable by the user.

2. Duplicate outputs of DMX data (DMX splitter) and discrete outputs shall be fully supported.

3. Merging of multiple DMX input sources on a single gateway without gateway with DMX output on the same gateway shall be supported without connection to the network. The gateway shall support assignment of priority to each input source independently.

4. File transmission, synchronization and access to software shall be supported.

B. Provide one (1) General Network.

IX. NETWORK/DMX EQUIPMENT RACK

A. A wall mounted Network/DMX Equipment Rack shall be provided to house Network data, DMX associated equipment, theatrical control devices and spare theatrical and house luminaire lamps in a fully functional, EIA compliant 19” panel mount assembly. The rack shall be MIDDLE ATLANTIC PRODUCTS (MAP) Model No. DWR Series or equal with an overall width of 24.4”, depth of 26.3” and height as needed to house all the equipment required and recommended by the theatrical system manufacturer. The rack’s center section and back panel shall be 16-gauge steel, phosphate pre-treated and finished in a black textured powder coat. Rack rails shall be constructed of 11-gauge steel with tapped 10-32 mounting holes in universal EIA spacing with black e-coat finish and marked rack spaces. Rack shall be constructed to swing open for component cabling access, center section shall pivot for either left or right opening. Rack shall be provided with suitable cable management modules.

B. The rack shall contain all of the rack mounted equipment set forth in these specifications, as shown on the Drawings and required by the system manufacturer. The rack shall also contain, but not be limited to the following:

1. Lockable sliding shelf to allow a 15.6” laptop computer to fit. (laptop provided by others)

2. Blank brushed panels for equipment mounting not designed for rack mounting but necessary for the operation of the system.

3. Blank brushed panels for future applications and to enclose all unused spaces.

4. One (1) rack mounted UPS unit rated 120 volt, 1000VA, MAP Model No. 1000R (Part No. PJPS1012) or equal with a nine (9) foot power cord with a NEMA 5-15P plug.

5. One (1) UH 5 Button Station.

6. One (1) Theatrical system wireless access point (Airport).

7. One (1) 24 port POE Switch and one (1) spare POE Switch.

8. One (1) 24 port Patch Panel.

9. Two (2) locking drawers, one (1) or more for spare lamps, labeled as “Spare Lamps”

10. Four (4) rack spaces with four (4) individual blank panels for future devices or equipment.

C. Spare Lamps:

1. All spare lamps for the Theatrical Lighting Instruments and House Lighting Luminaires shall be stored in their original cartons in a locking drawer in the NETWORK/DMX EQUIPMENT RACK. The drawer shall be sized as required to house all of the spare lamps. Provide additional locking drawers as needed. A directory listing of the type and location of each lamp shall be inside each drawer. Provide an engraved nameplate lettered SPARE LAMPS on the front face of the spare lamp drawer(s) for identification.

D. Provide one (1) Network/DMX rack. The rack shall have an engraved nameplate on the front face of the Network/DMX rack in a suitable location. The nameplate shall be lettered THEATRICAL LIGHTING SYSTEM NETWORK/DMX EQUIPMENT RACK.

X. DMX GATWAY – FOUR PORT

A. The lighting control gateway shall be a microprocessor-based unit specifically designed to provide DMX-512 control of lighting systems and transport of RDM configuration and status messages. The gateway shall permit DMX-512 data to be encoded, routed over an Ethernet network and decoded back to DMX-512. The unit(s) shall be a Net3 DMX 4-port Gateway as manufactured by ETC, Inc. or approved equal.

1. Gateway shall communicate over Ethernet directly with at least ETC, Inc.’s entertainment and architectural lighting control products and other Ethernet interfaces.

2. Connections shall be made between gateways, consoles, architectural systems, and PCs over standard Ethernet distribution systems using 10/100BaseT.

3. The gateway shall support multiple protocols including:

a) ANSI E1.17 Architecture for Control Networks (ACN).

b) ANSI E1.11 USITT DMX512-A.

c) ANSI E1.20 Remote Device Management (RDM).

d) Net3 protocol suite including ANSI E1.31 Streaming ACN (sACN).

4. The gateway shall be tested to UL standards and labeled ETL Listed.

5. The gateway shall be RoHS Compliant (lead-free).

6. The gateway shall be CE compliant.

7. The gateway shall have a backlit graphic LCD display for identification (soft-labeling) and status reporting. Labeling shall be user configurable using ANSI E1.17 Architecture for Control Network (ACN), Gateway Configuration Editor (GCE) software. The LCD display shall show DMX port configuration indication as well as indicate the presence of valid signal. Gateways that do not indicate port configuration (input/output) and valid data shall not be acceptable.

8. Each gateway shall have power and network activity LEDs on both the front and rear of the gateway.

B. DMX Ports:

1. DMX Ports shall comply with the requirements of ANSI E1.11 USITT DMX512-A standards.

2. Each DMX port shall be software-configurable for either input or output functionality.

3. Hardware configuration override setting shall be provided on the gateway.

4. DMX input shall be optically-isolated from the gateway electronics.

5. DMX output shall be earth-ground referenced.

6. DMX Port shall be capable of withstanding fault voltages of up to 250VAC without damage.

7. Each port shall incorporate one DMX512-A Connection.

a) Each DMX port shall be modular and hot swappable.

b) Each DMX port location shall support a single 5-pin male XLR, 5- pin female XLR or terminal strip module for DMX wiring.

8. Network gateways that do not indicate input/output port configuration or presence of valid data shall not be accepted.

C. Processor:

1. Each gateway shall have sufficient processing power to manage up to 63,999 universes (32,767,488 addresses).

2. Maximum delay time from input to output shall not be greater than one packet

time (approximately 22 mSec.).

3. A minimum DMX update rate of 40Hz shall be sustained under all conditions unless specifically configured for a slower rate for the sake of compatibility with 3rd party DMX devices.

D. Mechanical:

1. The gateway shall be fabricated of 16-gauge steel, finished in fine- texture, scratch-resistant, black powder coat.

2. Dimensions shall be 8.5” (22 cm) wide x 8.0” (20 cm) deep x 1.75” (5 cm) high.

3. The weight of the gateway shall be 3.5 lbs (1.6 kg) with four modules. An individual module shall weight no more than .25 lbs (.1 kg).

4. Mounting holes shall be provided for installation of a pipe mount accessory kit.

E. Power:

1. Power for the gateway shall be provided either over the Category 5e (or better) cable, utilizing IEEE 802.3af compliant Power over Ethernet distribution equipment, or via conventional switches together with isolated in-line power supplies capable of an operating range of 8-28vDC provided by the gateway manufacturer. Power consumption shall not be greater than 5 watts.

2. The gateway electronics shall be electrically isolated from the power supplied over the Category 5e (or better) cable.

3. Power may be provided from any IEEE 802.3af compliant power-over Ethernet distribution equipment, or by using conventional switches together with isolated in-line power supplies as provided by gateway manufacturer.

F. Configuration:

1. Each gateway on the network shall be individually configurable using:

a) Any devices utilizing ANSI E1.17 ACN communications.

b) Gateway Configuration Editor (GCE), running on a network connected PC. The PC shall only be required for configuration, labeling and signal routing, and shall not be required for normal operation of the system.

2. Each DMX gateway shall control up to 512 DMX addresses, within the confines of 63,999 universes. The specific DMX data input or output by the gateway shall be freely configurable by the user. Duplicate outputs of DMX lines (DMX splitter) and discrete outputs shall be fully supported.

3. Any number of DMX universes may be configured with any length up to 512 addresses. Any range of DMX input addresses shall support selection and routing to the specified sACN output.

4. Multiple sources may be combined and a priority may be assigned to each source. Each DMX port may have its own universe and start address.

5. All relevant routing information shall be stored in non-volatile memory at each gateway. The system shall recover from a power outage without requiring the PC to be online. Gateways that do not support non-volatile storage of data routing shall not be accepted.

G. Network:

1. Communications physical layer shall comply with IEEE 802.3i for 10BASE-T, 802.3u for 100BASE-TX and 802.3af for Power over Ethernet specifications.

2. All network cabling shall be Category 5e (or better), conforming to TIA- 568A/B, and shall be installed by a qualified network installer.

3. Data transport shall utilize the TCP/IP suite of protocols to transfer the DMX data.

4. ANSI E1.17 Architecture for Control Networks (ACN) and streaming ACN (sACN) shall be supported. Gateways that do not support ANSI E1.17 shall not be acceptable.

5. Switches shall comply with power-over-Ethernet IEEE802.3af, unless a separate in-line power supply is provided.

6. Multiple DMX signal routing patches and multiple facilities shall be supported and limited only by the file storage capacity of the computer with ETC Gateway Configuration Editor (GCE) Software installed.

7. Each DMX gateway shall control up to 512 DMX addresses, per DMX port within the confines of up to 64,399 universes (32,767,488 addresses) using Streaming ACN (sACN).

    a) Any range of DMX addresses may be selected for each universe.

    b) Multiple sources shall be supported by prioritized Highest Takes Precedence (HTP with priority). Each source shall support assignment of priority to allow override of default HTP behavior.

    c) Each DMX port shall support its own universe and start address.

8. Gateways shall have built in DMX merger capability on a universe or channel-by-channel basis.

9. Gateways shall support and have built-in priority on a per-universe or channel-by-channel basis. Gateways that do not support prioritized merging of multiple network sources at independent priorities shall not be accepted.

H. DMX Connector Modules:

1. Each gateway shall support up to four connector modules containing a single connector and its associated electronics.

2. Connector module options shall include:

    a) 5-pin Male DMX connector for DMX Input.

    b) 5-pin female DMX connector for DMX output.

3. Eight position terminal connector for DMX input or output supporting screw terminals or Insulation displacement (IDC) wire terminations.

4. Each connector module shall be optically-isolated from the gateway electronics and from each other.

5. DMX connector modules shall be capable of withstanding fault voltages of up to 250vAC without damage.

I. Environmental:

1. The ambient operating temperature shall be 0° to 40°C (32° to 104°F).

2. The storage temperature shall be -40° to 70°C (-40° to 158°F).

3. The operating humidity shall be 5% - 95% non-condensing.

J. Accessories shall be provided:

1. Hanging bracket kit shall allow unit to be mounted in three orientations.

    a) U-Bolt or C-Clamp mounting hardware shall be available.

2. One E.I.A. rack space mounting bracket kit shall support either one or two complete units and allow for up to eight ports of DMX.

3. Front Access Panel kit shall allow the connectors on the rear of the gateway to be accessed from the front of an equipment rack.

4. A Universal Power Supply with plug-sets shall be provided. Multiple power supplies shall be able to fit in a vertically stacked power strip.

5. ETC Gateway Configuration Editor Software (GCE).

K. System Requirements:

1. Provide the quantity and type of ETC gateways required for a complete installation.

2. Provide the quantities of Ethernet switches and power supplies required for a complete installation.

3. Provide a current generation PC with Windows XP operating system equipped with a 10/100 Ethernet card.

4. Systems that do not provide the above capabilities shall not be acceptable.

L. Provide one (1) Net3 DMX 4-port Gateway.

XI. DMX/RDM REPEATER (OPTO-SPLITTER)

A. The DMX/RDM Installation Repeater shall permit star-wiring of DMX512 signals and shall isolate DMX transmitters and DMX receivers from common mode voltages, ground loop currents and other electrical faults.

1. The DMX/RDM Installation Repeater shall have bi-directional ports to allow Remote Device Management (RDM) data packets to be sent and received between control systems and responding devices.

2. Each DMX/RDM Installation Repeater shall have one input port and eight output ports. No in-line processing of the input signal is permitted to ensure the highest reliability.

3. DMX signal splitting shall be provided using 4-output DIN-rail mounted modules for easy expansion and/or servicing.

4. The system shall be capable of repeating simplex protocols other than DMX512, provided they meet the electrical requirements of EIA-RS422 or RS485.

B. Physical:

1. Enclosures shall be constructed of formed or cast aluminum and steel.

2. The DMX Repeater shall be designed to mount in a single rack unit of height and shall include all necessary mounting hardware for this purpose.

3. The housing shall be provided in stain black textured power-coat finish. The front and rear panels will clearly identify ports and connectors with black print on a white background for legibility.

C. Electrical:

1. The power supply shall be a field-replaceable, wide-range input (115/240VAC, 50/60 Hz), UL-listed switching power supply. There shall be no power switch to reduce the chance of accidental shut-off.

2. There shall be 2500-volt electrical isolation between all input and output sections, and between adjacent output sections.

3. The input and each output shall be capable of withstanding the continuous application of up to 250V without damage to internal components. Input and

output protection shall be of the self-resetting type, rated for 250V. Replaceable fuses are not acceptable.

D. Field Connections:

1. All internal field wiring connections shall be clearly labeled according to their function.

2. Connections for all data input, output and pass-thru ports, and DC power shall be two-part, Phoenix-type screw terminal strips, capable of accepting #26 to #14 gauge solid or stranded wire.

3. An active, isolated data pass-thru connection port shall be provided to allow daisy-chaining of additional modules or Installation Repeaters.

4. The power supply connections shall be capable of accepting up to #12 gauge solid or stranded wire. A suitable terminal shall be provided for ground wire connection.

E. Features:

1. Each repeater module shall incorporate LED indicators for DC power input, isolated DC power, DMX input and processor status.

2. Each module shall have two LEDs per output port to indicate active DMX output and RDM activity for that port.

3. Each module shall be individually discoverable via RDM. No remote configuration options shall be available to the user.

4. Each DMX/RDM port shall incorporate an active data line terminator.

F. Compliance:

1. The DMX/RDM Installation Repeater shall be compliant with ANSI E1.11 DMX512-A (2004), USITT DMX512 (1990) and ANSI E1.20 Remote Device Management (2006).

2. The DMX/RDM Installation Repeater shall be ETL-listed.

3. The DMX/RDM Installation Repeater shall be compliant with the RoHS 2002/95/EC directive.

G. Acceptable Product:

1. Supply Pathway DMX/RDM Installation Repeaters only.

H. Provide one (1) rack mounted Pathway 8-way DMX/RDM Installation Repeater, or approved equal.

XII. TOUCHSCREEN CONTROL STATIONS (MASTER HOUSE LIGHT)

A. The Master House Light Control Stations shall be the Unison Paradigm Touchscreen P-LCD Series Control Stations as manufactured by Electronic Theatre Controls, Inc., or equal.

1. Touchscreen stations shall support default and fully graphical control pages.

2. The Touchscreen station shall operate using graphic buttons, faders and other images on at least 30 separate programmable control pages.

3. Touchscreen stations shall also allow programming of page pass-code, lock out and visibility levels.

B. Mechanical:

1. Touchscreen stations shall consist of a seven inch, backlit liquid crystal display (LCD) with a minimum resolution of 800 by 400 pixels and 12-bit color depth with a touch interface.

2. Touchscreen bezels shall be constructed of aluminum and shall have no visible means of attachment.

a) The bezel shall install and remove without the use of tools.

b) The bezel shall provide two working positions for the Touchscreen: service and operating.

3. The Touchscreen shall have a protective overlay over the display.

a) The overlay shall reduce wear.

b) The overlay shall reduce glare.

4. The manufacturer shall provide backboxes for all LCD stations.

a) Flush back box dimensions shall be 7.94” wide x 5.33” high x 3.25” deep.

b) Surface back box dimensions shall be 8.3” wide x 5.6” high x 2.55” deep.

C. Electrical:

1. Touchscreens shall be powered entirely by the System network.

2. Touchscreens shall connect to the System using an Ethernet network with Power over Ethernet (PoE) or the Unison control station Echelon® Link power network.

a) Ethernet Network

(1) Ethernet network shall be 10/100BaseTX, auto MDI/MDIX, 802.3af compliant.

(2) Network shall utilize Unshielded Twisted Pair (UTP) Category 5e wiring.

b) Echelon® Link power network

(1) Link power shall utilize low-voltage Class II unshielded twisted pair, type Belden 8471 or equivalent, and one #14 ESD drain wire (when not installed in grounded metal conduit).

(2) Touchscreen stations shall also require (2) #16 AWG stranded wires for 24Vdc operating power. 24Vdc wiring shall be topology free.

(3) Network wiring may be bus, loop, home run, star or any combination of these.

(4) Network insulation displacement connectors shall be provided with all stations.

D. Functional:

1. System

a) The Touchscreen shall support configuration firmware upload from a Paradigm Processor as proxy.

b) The Touchscreen shall support configuration or firmware upload from local removable media.

2. Setup Mode

a) There shall be a setup display that is separate from any user- defined configuration.

b) It shall be possible to view and modify connectivity settings.

c) It shall be possible to view status information.

d) It shall be possible to view and modify LCD screen settings.

e) It shall be possible to perform Touchscreen calibration.

f) It shall be possible to view and modify audio settings.

g) The appearance of the setup display shall be standard and not editable.

h) The setup display may be invoked from within the user-defined

configuration and/or physical button on the Touchscreen.

i) There shall be a default protected method to invoke the setup display.

3. Configurations

a) It shall be possible to have multiple configurations stored within an LCD Station.

b) Only one configuration may be active on the LCD Station.

c) It shall be possible for Touchscreen Stations connected via the Echelon® Link power network to select a configuration automatically based on the configuration of the physical connection.

d) Where multiple configurations are stored there shall be a boot menu to allow selection of a configuration.

e) Each configuration shall be identified as a different Station within the System.

4. Operation

a) The Unison Paradigm Control System shall be designed to allow control of lighting and associated systems via Touchscreen controls. System shall allow the control of presets, sequences, macros and time clock events.

(1) System presets shall be programmable via Button, Button/Fader, Touchscreen, or LightDesigner software.

(a) Presets shall have a discrete fade time, programmable from zero to 84,600 seconds with a resolution of one hundred milliseconds.

(b) Presets shall be selectable via Touchscreen stations.

(2) System macros and sequences shall be programmable via LightDesigner system software.

(a) Macro and sequence steps shall provide user selectable steps, and allow the application of conditional logic.

(b) Macro and sequences shall be activated by button, time clock event or LightDesigner software.

(3) System clock events shall be programmable via the Touchscreen, LightDesigner system software, the processor user interface, or the internal web server.

(a) Time clock events shall be assigned to system day types. Standard day types include: anyway, weekday, weekend, Sunday, Monday, Tuesday, Wednesday, Thursday, Friday and Saturday. System shall support programming of additional custom or special day types.

(b) Time clock events shall be activated based on sunrise, sunset, time of day or periodic event. System shall automatically compensate for regions using a fully configurable daylight saving time.

(4) A Color picker, supporting Hue, Saturation and Brightness (HSB) color selection shall be available for color selection of color changing fixtures and provide visual feedback of the current color produced by the associated fixture.

(a) The color picker shall be provided with a default layout that requires no user configuration.

(b) The Color Picker shall provide RGB faders in addition to the default HSB color wheel for color selection.

(c) Color picker values shall allow for numerical value input in addition to color wheel and fader control.

(d) The color picker shall be compatible with color mixing systems that use up to seven discrete color control channels.

b) Touchscreen stations shall be designed to operate standard default or custom system functions. Components shall operate default functions unless re-assigned via LightDesigner, the Windows-based configuration program.

(1) Optional button functions include: preset selection, manual mode activation, record mode activation, station lockout, raise, lower, macro activation, and cue light, or room join/separate.

(2) Optional fader functions include master control, individual channel control, fade rate control or preset master control.

c) Touchscreen stations shall allow programming of station and component electronic lockout levels via LightDesigner.

d) It shall be possible to adjust LCD contrast and brightness.

e) It shall be possible to program the station to dim during periods of inactivity.

E. Provide two (2) Paradigm LCD touchscreen station.

XIII. CONTROL STATIONS

A. Button Stations

1. The Lighting Control Stations shall be the Unison Heritage UH Series Control Stations as manufactured by Electronic Theatre Controls, Inc., or equal.

2. Mechanical:

a) The button stations shall operate using up to ten programmable buttons.

b) All button stations shall be available with white, cream, ivory, gray or black faceplates, and buttons.

(1) Manufacturer's standard colors shall conform to the RAL CLASSIC Standard.

c) Stations shall have indicators lights at each button.

(1) Indicators shall be comprised of red, green and blue LED's.

(2) Indicator color and state (steady On, Blink, Off) shall be configured in software, and shall operate relative to the button it is associated with.

d) All faceplates shall be designed for flush or surface mounting.

e) Station faceplates shall be constructed of ABS plastic and shall use no visible means of attachment.

f) Station faceplates shall be indelibly marked for each button or fader function.

g) The manufacturer shall supply back boxes for flush mounted half gang stations and for all surface mounted stations.

h) All Button stations shall be designed to accept the infrared signal from a remote hand held IR transmitter.

(1) The stations shall have a 60° reception angle and shall operate reliably within a 45-foot distance.

3. Electrical:

a) Unison control station wiring shall be an Echelon® Link power network.

(1) Link power shall utilize low-voltage Class II unshielded twisted pair, type Belden 8471 or equivalent, and one #14 ESD drain wire (when not installed in grounded metal conduit).

(2) Touchscreen and Interface stations shall also require (2) #16 AWG stranded wires for 24Vdc operating power. 24Vdc wiring shall be topology free.

(3) Network wiring may be bus, loop, home run, star or any combination of these.

(4) Network insulation displacement connectors shall be provided with all stations.

4. Functional:

a) The Unison Paradigm Control System shall be designed to allow control of lighting and associated systems via Button, Interface or Astronomical time clock controls. System shall allow the programming of presets, sequences, macros and time clock events.

(1) System presets shall be programmable via Button, Touchscreen, or LightDesigner software.

(a) Presets shall have a discrete fade time, programmable from zero to 1,000 hours with a resolution of one millisecond.

(b) Presets shall be selectable via button, IR transmitter, time clock event, macro activation or switch interface stations.

(2) System macros and sequences shall be programmable via LightDesigner system software.

(a) Macro and sequence steps shall provide user selectable steps, and allow the application of conditional logic.

(b) Macro and sequences shall be activated by button, time clock event or LightDesigner software.

(3) System time clock events shall be programmable via LightDesigner system software, the processor user interface, or the internal web server.

(a) Time clock events shall be assigned to system day types. Standard day types include: anyway, weekday, weekend, Sunday, Monday, Tuesday, Wednesday, Thursday, Friday and Saturday. System shall support programming of additional custom or special day types.

(b) Time clock events shall be activated based on sunrise, sunset, time of day or periodic event. System shall automatically compensate for regions using a fully

configurable daylight saving time.

b) Station Button, and Interface control components shall be designed to operate standard default or custom system functions. Components shall operate default functions unless re-assigned via LightDesigner, the Windows-based configuration program.

(1) Button functions shall allow preset selection, manual mode activation, record mode activation, station lockout, raise, lower, macro activation, cue light, or room join/separate.

c) Button Stations shall allow programming of station and component electronic lockout levels via LightDesigner.

B. Connector Stations

1. The Lighting Control Stations shall be the Unison Heritage UH Series Control Stations as manufactured by Electronic Theatre Controls, Inc., or equal.

2. Mechanical:

a) Unison connector stations shall provide an interface to portable Unison stations.

b) All connector stations shall be available with white, cream, ivory, gray or black faceplates, fader knobs, and buttons.

(1) Manufacturer's standard colors shall conform to the RAL CLASSIC Standard.

c) All faceplates shall be designed for flush or surface mounting.

d) Station faceplates shall be constructed of ABS plastic and shall use no visible means of attachment.

e) Station faceplates shall be indelibly marked for each function.

f) The manufacturer shall supply back boxes for flush mounted half gang stations and for all surface mounted stations.

3. Electrical:

a) Unison control station wiring shall be an Echelon® Link power network.

(1) Link power shall utilize low-voltage Class II unshielded twisted pair, type Belden 8471 or equivalent, and one #14 ESD drain wire (when not installed in grounded metal conduit).

(2) Touchscreen and Interface stations shall also require (2) #16 AWG stranded wires for 24Vdc operating power. 24Vdc wiring shall be topology free.

(3) Network wiring may be bus, loop, home run, star or any combination of these.

(4) Network insulation displacement connectors shall be provided with all stations.

4. Functional:

a) The Unison Paradigm Control System shall be designed to allow control of lighting and associated systems via Button, Button/Fader, and Interface or Astronomical time clock controls. System shall allow the programming of presets, sequences, macros and time clock events.

(1) System presets shall be programmable via Button, Button/Fader, Touchscreen, or LightDesigner software.

(a) Presets shall have a discrete fade time, programmable from zero to 1,000 hours with a resolution of one millisecond.

(b) Presets shall be selectable via button, fader, IR transmitter, time clock event, macro activation or switch interface stations.

(2) System macros and sequences shall be programmable via LightDesigner system software.

(a) Macro and sequence steps shall provide user selectable steps, and allow the application of conditional logic.

(b) Macro and sequences shall be activated by button, time clock event or LightDesigner software.

(3) System time clock events shall be programmable via LightDesigner system software, the processor user interface, or the internal web server.

(a) Time clock events shall be assigned to system day types. Standard day types include: anyway, weekday, weekend, Sunday, Monday, Tuesday, Wednesday, Thursday, Friday and Saturday. System shall support programming of additional custom or special day types.

(b) Time clock events shall be activated based on sunrise, sunset, time of day or periodic event. System shall automatically compensate for regions using a fully configurable daylight saving time.

(c) .5A@120V

C. Provide four (4) Unison Heritage Push Button Station (UH10007-1F).

XIV. DATA PLUG-IN STATIONS

A. Data Plug-in Stations shall consist of the appropriate connectors required for the functional intent of the system. These stations shall be available with DMX input or output, Remote Focus Unit, Network, or architectural control connectors as shown on the Drawings or as required.

B. Connector Options:

1. The following standard components shall be available for Plug-in Stations:

a) 5-Pin male XLR connectors for DMX input

b) 5-Pin female XLR connectors for DMX output

c) RJ45 connectors for Network connections - Twisted Pair

C. Physical:

1. Station faceplates shall be .80” aluminum, finished in fine texture, scratch-resistant black powder coat. Silk-screened graphics shall be white.

2. The station panel shall mount into an industry standard back box, depending on size and quantity of connectors. A terminal block shall be supplied for contractor terminations.

D. Provide Data Plug-In Stations of the types and quantities as follows:

1. Two (2) ECPB DMX OUT/NET

2. One (1) ECPB DMX/NET

3. One (1) ECPB NET

XV. EMERGENCY LIGHTING TRANSFER SYSTEM

A. Provide an Emergency Lighting Transfer System (ELTS2) to provide automatic transfer of branch circuits from normal to emergency power when normal power fails. Each system shall consist of power transfer switches and a control circuitry interconnected to provide complete, automatic protection.

1. The ELTS shall transfer designated lighting load branch circuits from dimmers or secondary control outputs to a second power source in the event of a loss of power to the dimmer rack, a normal system failure, or activation of fire alarm.

2. The system shall comply with ANSI / UL1008 Transfer Switch Equipment, ANSI / NFPA 110 Standard for Emergency and Standby Power Systems, and ANSI /

NFPA 70 National Electrical Code (NEC). Emergency transfer systems that do not comply with the below stated NEC articles and sections shall not be permitted:

a) Article 700 – Emergency Systems

b) Article 701 – Legally Required Standby Systems

c) Article 702 – Optional Standby Systems

d) Section 518.3(C) – Assembly Occupancies

e) Section 520.8 – Theatres and Similar Locations

f) Section 540.11(C) – Motion Picture Projection Rooms

3. The ELTS shall be a self-contained system for up to 24 circuits at 20 amps each and available for single or three phase power (120/208V). The unit shall be available with either discrete emergency branch circuit feeds from an external circuit breaker panel (by others) or emergency main feed with built-in branch circuit distribution and over current protection, as shown on the Drawings.

B. Transfer Switch

1. The switch shall be a UL 1008 LISTED, electrically operated and mechanically held (maintained) transfer switch.

2. The switch shall be positively locked and unaffected by voltage variations or momentary outages so constant contact pressure is maintained and temperature rise at the contacts is minimized.

3. The switch shall be mechanically interlocked to ensure only one of the two possible positions, either Normal or Emergency.

4. Each switch shall be configured as guaranteed break-before-make.

5. Built-in fuses shall provide up to 65,000A Short Circuit Current Rating (SCCR) on connected emergency circuits.

6. Built-in fuses class G shall be provided on each output for compliance with NEC Section 700.27 Coordination – larger upstream breakers cannot be tripped by downstream branch circuit faults.

7. Switch contacts shall withstand transfer without welding, with 180º phase displacement between Normal and Emergency power sources, both sources energized and with 80% load.

8. Transfer switch contacts shall be rated for mixed loads, including electric discharge lamps and tungsten filament lamps.

9. Transfer switches shall be rated for 6000 cycles at full tungsten load.

C. Control Circuit

1. The control circuitry shall direct the operation of the transfer switch.

2. User configurable timing delays shall be provided for power transfer between:

   a) Loss of normal power and the transfer to emergency up to 10 seconds.

   b) Restoration of normal power and the transfer from emergency back to normal power up to 60 seconds.

3. A normally closed dry contact closure fire alarm input shall be provided.

4. Transfer switch shall support connections for up to 5 Remote Stations which can manually switch between normal and emergency power.

D. Operation

1. Transfer to alternate supply will occur when normal supply voltage drops below 80V when used at 120V, or 185V for the A phase and 80V for the B and C phase when used at 277V.

2. A self-supervising isolated signal input shall be provided for connection to the facility fire alarm. The ELTS2 shall automatically transfer the loads to the Emergency power source when the facility fire alarm is activated as part of a normally-closed loop.

3. A key-operated switch shall be provided to manually control the ELTS2. All automatic functions shall override this control. Two indicator lights shall be provided to show the position of the transfer switch.

4. All automatic functions shall override remote control functions. Any combination of open or shorted wiring to remote stations shall not affect automatic functions, or disable the local switch.

E. Enclosure

1. The ELTS2 shall be mounted in a NEMA 1 interior or NEMA 4 watertight type enclosure finished in textured epoxy paint. It shall be equipped with a hinged locking door. Material shall be no less than 14-gauge steel.

2. An enclosure containing no more than 12 (twelve) 20A circuits shall be 36”H x 24” W x 8.5” D.

3. An enclosure containing up to 24 (twenty-four) 20A circuits shall be 48”H x 30” W x 8.5” D.

4. The enclosure shall provide power distribution and branch circuit protection for all emergency power circuits. Systems requiring external emergency power circuit protection shall not be acceptable.

5. The enclosure shall be separate and independent of all other equipment. In no instance shall the ELTS2 be enclosed in a dimmer rack or in an enclosure containing other equipment.

6. The system shall be provided with an approved overlay mounted on the front of the enclosure, stating, “EMERGENCY LIGHTING TRANSFER SYSTEM”.

7. The enclosure shall be provided with an approved label indicating that the system is UL1008 LISTED.

F. The manufacturer of the ELTS shall be the same manufacturer as the dimming system equipment rack manufacturer, or approved equal.

G. Provide one (1) Emergency Lighting Transfer System (ELTS2).

XVI. LIGHTING CONSOLE AND ACCESSORIES

A. The lighting control console shall be a microprocessor-based system specifically designed to provide complete control of stage, studio, and entertainment lighting systems. The console shall be the “Ion” as manufactured by Electronic Theatre Controls, Inc., or equal.

1. The control system shall be Net3 and Net 2 native, with both protocols output simultaneously over the network. The system shall also be able to control third party ANSI e1.31 sACN/ACN devices directly. Artnet and Avab UDP protocols shall also be available. The system shall provide control of 1024 outputs on a maximum of 10,000 control channels.

2. A maximum of 10,000 cues, 999 cue lists, 1000 groups, 1000 presets, 4 x 1000 palettes (Intensity, Focus, Color and Beam), 1000 effects, 1000 macros and 100 curves may be contained in non-volatile electronic memory and stored to an onboard hard disk or to any USB storage device.

3. Recorded cue lists may be played back simultaneously on a maximum of 200 faders. Channels shall respond to cue information by last instruction with discrete rate control provided for all cues. The console may be placed in Tracking or Cue Only mode by the user as a system default and overridden on individual record actions as required. HTP/LTP intensity flags, assert, proportional, intensity master or manual master fade control and independent status may be placed on each cue list. It shall also be possible for a cue list to contribute to playback background states or to withhold such contributions.

4. A Master Playback fader pair and dedicated Grand Master/Blackout shall be provided.

5. Up to six USB fader wings may be connected to the console, for a maximum of 300 submasters and/or 200 playback faders. USB fader wings may be rigidly connected to the main console to provide a "single connected unit" with no external cables required. The wings also may be connected via USB cables and used "on the side." Virtual fader control is also provided.

6. A high-resolution level wheel shall be provided to control intensity for selected channels and scrolling within selected displays. Four page-able high-resolution encoders shall be provided for control of other non- intensity parameters. Non-intensity parameters shall be controllable via the encoders or keypad controls, without need of an external pointing device. A high-resolution rate wheel shall also be provided.

7. Rotary encoders for non-intensity parameters must be labeled by means of an integral LCD display mounted below the encoders on the main console. The display shall show the currently loaded functions of the encoders based on the current selections.

8. Control and programming features for automated fixtures shall also include: a standard library of fixture profiles, the ability to copy and edit existing profiles and create new profiles, patch displays including channel and output addressing, 16-bit fade resolution, color characterization allowing color mixing and storing in Hue and Saturation or native device values.

9. System information, including playback status, live output and blind values for all record targets shall be displayed on a maximum of two external high resolution DVI monitors, or one SVGA monitor, which may also be touch-screen(s). Only one display shall be required for operation.

10. A context sensitive on-line Help feature shall explain and provide an example of the operation of each feature of the system.

11. An optional, fully-functioning, detachable alphanumeric keyboard shall be provided. The keyboard shall allow labeling of channels, cues, presets, groups, palettes, effects, macros, curves and the show. An integral electronic keyboard shall be provided.

12. A row of softkeys shall be provided, which change function based on the selection and context of the console. These softkeys must be labeled via an adjacent LCD display that shows their current functions at all times.

13. Console software upgrades shall be made by the user via a USB port; changing internal components shall not be required. It shall be possible to install software updates in all consoles, processor units and remotes from one device over the network.

14. The console operating software shall be loaded into program execution memory from the internal hard drive when the console is powered. In the event of an uncontrolled shutdown, the console shall return to its last output state when power is restored.

15. Integrated dimmer monitoring features shall be provided to allow indication of dimming system status, error states and dimmer load monitoring. Adjustment of dimmer configuration shall also be supported. Communications with the dimming system shall utilize ANSI E1.17 2006 - Entertainment Technology - Architecture for Control Networks.

16. Integrated RDM device features shall be provided. The console shall discover and patch RDM device. The console shall monitor RDM devices to allow indication of RDM device online/offline status error states. The console shall be capable of changing settings of RDM devices such as changing the DMX start address. Communications with the RDM devices shall utilize ANSI E1.20 2006 – Remote Device Management.

17. Show data may be created and modified on a personal computer, using either Windows XP or Windows 7 operating systems, using a free offline editing application. The offline editor may also run natively on Macintosh platforms using OS X.

18. A computer, using either Windows XP or Windows 7, or a Macintosh (Intel only) running OS X using the offline software application shall be able to connect to a control system via the network and view or modify current show data in an independent display environment using an Eos Client Dongle. When connected without the dongle, the computer shall operate in Mirror Mode, with the device to be mirrored selectable by the user.

19. Synchronized backup shall be provided via another full console on the network or by use of a remote processor unit. The backup unit (either full console or rack mounted Remote Processor Unit (RPU) shall maintain synchronized playback with the master and shall take over control of the lighting system upon loss of communication with the master. Use of two RPUs to service and backup system output is also supported. Systems must offer this kind of instant backup from multiple sources.

20. A maximum of four users may access and interact with show data simultaneously. Each user shall have an individual workspace and channel partitioning shall be supported.

21. Mirror mode shall allow the console displays and operating modes to be mimicked on another connected device. Alternatively, the console may mirror another device.

22. The system must allow remote control from external devices as follows: Client software running on a PC connected to the network, a remote video interface with keyboard, a purpose-built wireless remote focus unit (Radio Focus Remote). Universal fader wings may be attached to any of these devices for local fader control.

23. The system shall support a Telephone remote control that allows basic functions to be controlled from a standard wireless phone producing touch-tone signals. This allows the use of a standard telephone for a low cost remote control. Systems must allow this function.

24. Network management tools shall be provided from the desk itself.

25. The system shall support up to 32 individual Time Code Event lists.

B. Controls and Playback

1. Manual Control and Programming Section

a) The console keyboard shall be grouped by function. Major groupings shall be record target functions, numeric keys, level assignment functions, display navigation functions and controls.

b) Non-intensity parameters may be set numerically or via the encoders. This control shall be fully interactive. In either case the current parameter value must be displayed on the console monitor and simultaneously on the console LCD display.

c) Only those parameters available for control in the active lighting system shall be displayed for control.

d) Lamp controls provide direct access to luminaire functions such as striking and dousing arc lamps and calibrating entire fixtures or individual mechanisms of fixtures, as provided by the luminaire manufacturer. User access to these features is normalized across all manufacturers for ease of use. Use of a “control channel” for accessing these functions shall not be required and systems requiring use of a control channel shall not be acceptable. Lamp control commands maybe staged, and channels which have been sent lamp ON commands shall be indicated in LIVE.

e) Fan functions shall be provided both via command line operation and through encoder controls.

f) Highlight shall be supported, with user definable highlight values. Lowlight conditions may be defined for selected, but not specified channels. Rem Dim command, at specific levels by channel, may be optionally and automatically called with the highlight command.

g) Fixtures with CMY or RBG color mixing may be set with direct CMY or RBG controls, as well as the Hue and Saturation encoders and/or color picker. Color may also be set directly to a gel match, via a graphic selection tool or from the command line.

h) The Virtual Media Server function shall allow the user to create layouts of devices, identified as pixel maps. Media content (images, movies, text and procedurally generated effects) may then be applied, manipulated and stored. Stock content is provided and the user may import his own imagery and animations. 40 Pixel maps, each with 12 layers, may be created.

i) Macros may be set to run as default. Default macros called manually shall post to the command line, but executed via cue lists shall run in the background. The user may override this behavior by defining the macro to always execute in the foreground or the background, regardless of the recall method.

2. Playback Section

    a) The master fader shall consist of a 60mm Master Fader pair with associated Load, Go and Stop/Back buttons. Additional playback faders may be configured via the virtual fader module or on the Universal Fader Wings.

    b) It shall be possible to instantaneously halt an active cue, back to the previous cue, manually override the intensity fade or manually override the entire fade.

    c) It shall be possible for a cue list to contribute to the background state or for the contents of each cue list to be withheld from such.

    d) The playback faders shall have the following associate controls:

        (1) Freeze, which halides the output of the fader

        (2) Step Effect, which stops the action of an effect.

        (3) Filter, to assign filter states to a fader

        (4) Go to Cue 0, to reset a cue list.

3. Fader Wings

    a) Submaster and fader support shall be provided via a 2X10 fader wing. Up to six of these wings may be connected to the desk via internal or external USB. Via paging, access is provided to all 300 faders, regardless of the number of physical wings attached.

    b) The 2x10 fader wing must include a full-length LCD for labeling and identification functions. Each fader must have two associated hard buttons for various operations.

    c) Up to 300 proportional, fully overlapping additive, effect or inhibitive submasters may be defined. Submasters shall have colored LEDs to indicate submaster status. Each submaster may have fade up, dwell and down fade times. Each has a bump and assert/channel select button. Submasters may be set to independent, exclusive, shielded and proportional/intensity master control.

    d) The submaster blind buffer shall be linked directly to live playback allowing live editing of live submaster content via the command line.

    e) It shall be possible to set submaster values directly from the command line.

    f) Up to 200 cue lists may be active concurrently.

4. Grand Master

    a) A dedicated grand master and blackout button are provided.

    b) The grand master shall proportionally fade intensity values to zero. Blackout shall send all intensity outputs to zero. Non- intensity outputs shall not be affected. No additional configuration shall be required to withhold non-intensity values from Grand Master and Blackout control.

C. Display Controls

1. Format shall change the view of selected displays.

2. It shall be possible for the user to choose which parameter categories or parameters (s)he wishes to display.

3. Flexichannel shall change which channels are viewed in selected displays, based on a variety of different criteria, including all, patched channels, show channels, active/moved channels, selected channels, manual channels, channels with discrete timing and user selectable channel views.

4. Expand shall extend the selected view sequentially across connected displays.

5. Time shall display discrete timing data.

6. Data shall display absolute values of referenced data.

D. Operating Modes

1. Live Modes

    a) Channel lists may be constructed using the +, - and Thru keys as well as the direct selects. Channel selection and deselection is fully interactive, regardless of the method used.

    b) Levels may be set with the keypad, level wheel and non-intensity encoders. “Selected” channels shall be those last addressed and under keypad control.

    c) Sneak shall be used to restore specified channels to background states, default values, or to send them to specified values, in user specified or default times.

    d) Selected channels may be set at a level or held to current values while all other channels are set to zero using Rem Dim. Toggling Rem Dim shall restore all unselected channels to original levels. The Rem Dim level shall be user definable via the command line or with a default setup value.

    e) Channels may be recorded into groups for fast recall of commonly used channels. 1000 groups shall be available. Groups shall store selection

order. The Offset function supports rapid creation of ordered groups, including reverse and random order.

f) Parameter settings may be stored to Intensity, Focus, Color and Beam Palettes and to Presets. All referenced data may be stored to whole numbers or to up to 99 decimal places between each whole number. It shall be possible to store 1000 presets and 1000 of each palette type.

g) Any collection of channel data, as determined by the use of “Record”, “Record Only, selective store commands and/or parameter filters may be stored to palettes (as appropriate to the type) and presets.

h) The following conditions may be placed on a channel or channel parameter to be included with a cue record action.

(1) Discrete fade time and/or delay

(2) Block flag

(3) Assert flag

(4) IFCB Filters, which may be set at a parameter level.

i) 999 cue lists may be stored. Cues may be recorded in any order. Up to 99 decimal cues may be inserted between any two whole number cues. Each cue may contain a maximum of twenty parts. Parameters may be automatically assigned to specific parts or assigned when the part is created.

j) It shall be possible to record cues and cue parts with the following information:

(1) Any collection of channel data, as determined by the use of “Record”, “Record Only” or selective store commands, combined with parameter filters.

(2) Cue Level timing and delays for Intensity Up, Intensity Down, Focus, Color and Beam.

(3) Follow or hang time

(4) Link instruction

(5) Loop value

(6) Block, Assert, Allfade, preheat and/or Mark Flag

(7) Curve

(8) Label and note

(9) Execute list to trigger other activity

k) Non-intensity channel parameters may be marked (preset), in two ways. Automark presets any parameters transitions in the cue just prior to intensity becoming active. Automark may be disabled on a cue or cue part basis, enabling a “live” move. Alternatively, non-intensity parameters may be marked to a specific cue with a single command instruction. It shall not be necessary to store these parameters directly into the cue in which the movement is to occur.

l) Any channel parameter may be stored with an effect instruction. These effects may contain relative offsets from current value, or absolute instructions. Effects may be progressive action or on/off states. Entry and exit behaviors shall modify the channel parameters activity when beginning and ending the effect.

m) Update may be used to selectively add modified parameter data quickly to that parameter’s current source. It shall be possible to update inactive record targets. It shall also be possible to update back to the current source of the move instruction without specifying that cue via Trace

n) Recall From quickly pulls specified data from record targets or other channels into the current view.

o) Copy To quickly copies selected data to specified channels or other record targets.

p) Address and channel check functions shall be provided.

q) Channel parameters may be “parked” at levels. Output addresses may also be parted directly. Parked levels shall not be added to any live record operations, nor may they be changed until the parked element is “unparked”. Address Park shall also be provided.

r) About shall provide detailed status of selected channels or specified record targets, including utilization information. About shall also access lamp control functions to calibrate devices, strike and douse arc sources. Use of a luminaire control channel for these functions shall not be acceptable.

s) 1000 snapshots may be stored which instantly recall specified front panel and display configurations.

t) Live data may be displayed in a summary view or detailed table orientation.

u) Undo shall be used to sequentially step back through manual operations, record, update and delete actions. Redo functions shall be provided. Multiple undo commands may be executed at once.

v) Home shall set selected channels non-intensity parameters to their default values. User definable home, on a per channel basis, shall be provided.

w) Move shall allow all show data to be moved from one record target to another.

2. Blind

a) The Blind display allows viewing and modification of all record targets without affecting stage levels.

b) Record target data may be displayed in a summary view, a detailed table orientation or a spreadsheet view, which allows quick data comparisons, move and replace with functions.

c) Changes made in blind displays shall be automatically stored.

d) Blind editing shall be possible for all record targets.

e) Selection of what parameter data to view for blind editing shall be user configurable.

3. Patch Display

a) Patch shall be used to display and modify the system control channels with their associated library data.

b) Each channel may be provided with a proportional patch level, preheat, curve, label, swap and invert functions.

c) Offset functions in patch shall allow selection of channel ranges and shall allow the user to establish a “custom” footprint for any device output.

d) Custom color wheels, color scrolls and gobo wheels shall be defined in patch. These devices shall be created with a simple table and graphical user interface supported by images of major manufacturers.

e) Copy to and Move functions shall be supported in patch.

f) RDM discovery and device monitoring shall be supported.

4. Setup/Browser

a) Setup shall access system, show and desk configurations.

b) The browser shall access show data storage, import, export, print to .pdf and clear functions, as well as show data utilities.

E. Interface Options

1. The console shall support a variety of local interfaces.

    a) AC input.

    b) USB (five ports for connecting devices such as an Alphanumeric keyboard, mouse, touch screens, USB Flash drive, fader wings, etc.) The desk shall provide four ports on the rear of the console and one on the control service itself.

    c) Ethernet (one port) 802.3af compliant

    d) Two DVI video output connectors, supporting a maximum of two DVI monitors at 1280x1024 resolution minimum.

    e) One VGA output connector.

    f) Up to six fader wings may be attached to the main console via internal or external USB connections. Systems must allow the addition of fader wings.

F. Accessories Required

1. iPFR and iRFR Preview (application for iPhone, iPod Touch and iPad units)

2. aRFR (application for Android devices)

3. 2x10 Universal Fader Wing

4. Ion Client Software Kit

5. One (1) 50’ Net Cable

6. One (1) 10’ Net Cable

7. Two (2) 19” ELO1928L LCD Touchscreen Monitors with DVI cable

G. Physical

1. All operator controls and console electronics for a standard system shall be housed in a single desktop console, not to exceed 19” wide, 19” deep, 5.5” high, weighing 20 pounds. Consoles must fit in a 19" rack.

2. Console power shall be 95 – 240V AC at 50 or 60Hz, supplied via a detachable power cord.

H. Provide One (1) ION 1000 or current equivalent.

XVII. ELECTRICAL DISTRIBUTION EQUIPMENT

A. All distribution equipment shall be furnished by the manufacturer of the dimming

equipment. Hanging and supporting hardware shall be furnished and installed under SECTION 11064 "THEATRE AND STAGE EQUIPMENT - RIGGING SYSTEMS".

B. Connector Strips shall be furnished and installed for the stage and catwalk where shown on the Drawings.

1. Each connector strip shall be complete with three-pole, 20A grounded stage pin connector type female receptacles.

2. Internal wiring shall be sized to circuit ampacity and shall be rated at 125°C.

3. Terminations shall be at one end using feed-through terminals individually labeled with corresponding circuit numbers.

a) 20 amp circuits shall use screwless tension clamp terminals listed for 20 – 8-gauge wire.

b) Terminals that place a screw directly on the wire are not acceptable.

4. Connector strips shall be supplied with appropriate brackets and hardware for mounting as shown on the Drawings.

a) Connector strips shall have junction brackets on 5’ centers.

b) Brackets shall be 1 ½” x .188” ASTM A 36 steel.

c) Hardware shall be ASTM A307 grade 5.

5. A low voltage distribution system shall be available to incorporate DMX, Ethernet or other protocols as specified in the connector strip. Connector strips shall utilize a voltage barrier to accommodate these systems. Low Voltage signals shall enter the connector strip via a strain relief or connector mounted in a separate low voltage terminal box at the specified end of the connector strip. Up to four low voltage cables shall be supported for each connector strip.

a) Connector strips with multiple DMX outputs from the same source shall use DMX pass through assemblies consisting of a 6” panel with the one DMX output connector, one DMX input (Pass Through) connector, one DMX pass through (Bypass) switch, and a label detailing the use of the pass-through assembly.

b) The bypass switch shall be used when no DMX devices are present at that location. When activated, the DMX pass through switch shall pass DMX directly through to the next DMX panel on the strip. The pass-through switch shall have a mechanical indicator to show the operator that it has or has not been engaged

6. Physical:

a) Connector strips shall be 6.25” H x 3.3” D and fabricated from 18-gauge galvanized steel and finished in black fine-texture powder coat

paint.

b) Covers shall be fabricated from 16-gauge galvanized steel.

c) Connector strips shall be available in any length specified in increments of 6” and shipped fully wired with all splicing hardware.

d) Connector outlets shall be spaced on 18” centers, or as otherwise specified or shown on the Drawings.

e) Outlets shall be mounted on individual 3” panels.

f) No external terminal boxes shall be required for connector strips with 28 or fewer circuits unless otherwise specified.

g) Circuits shall be labeled on the connector strip with 2” high lettering. Circuit labeling shall be located on the front side of the connector strip with white lettering on black background.

7. Connector strips shall support and include optional LED indicators to indicate the presence of power at each local circuit. The LED indicator shall be red in color and mounted in the connector strip directly below the outlet panel.

8. Connector Strips shall be Underwriter Laboratories (UL) LISTED. The connector strips shall be the Electronic Theatre Controls, Inc. 99 series or equal.

C. Plug-in Outlet Boxes shall be furnished and installed where shown on the Drawings.

1. Plug-in outlet boxes shall be complete with three-pole, 20A grounded stage pin connector type female receptacles attached to twenty-four (24) inch pigtails.

2. Pigtails shall be three-wire type “SOW” rubber jacketed cable sized for the maximum circuit ampacity.

3. Pigtails with 20-amp stage pin connectors shall be terminated using 12 gauge 4-way indent crimp (with inspection window) type where the wire is inserted and crimped directly in the socket.

4. Terminations for pigtail connectors shall utilize feed-through terminals individually labeled with corresponding circuit numbers. 20 amp circuits shall use screwless tension clamp terminals listed for 20 – 8-gauge wire. Terminals that place a screw directly on the wire are not acceptable.

5. Pigtail outlet boxes shall be supplied with appropriate brackets and hardware for mounting as shown on the Drawings.

a) Standard mounting options shall include pipe or wall mounting.

b) Brackets shall be made from ASTM A 36 steel.

c) Hardware shall be ASTM A307 grade 5.

6. A low voltage distribution system shall be available to incorporate DMX, Ethernet or other protocols as specified in the plug-in outlet box where shown on the Drawings.

    a) A voltage barrier shall be used to separate the low voltage wiring for the electrical circuits.

7. Physical:

    a) Plug-in outlet boxes shall be 6.25” H x 3.3” D and fabricated from 18-gauge galvanized steel and finished in black fine-texture powder coat paint.

    b) Covers shall be fabricated from 16-gauge galvanized steel.

    c) Plug-in outlet boxes shall be available in any length specified in increments of 3-inches with a maximum length of up to 3-feet.

    d) Pigtails and outlets shall be spaced on 4” centers, or as otherwise specified.

    e) Pigtail outlets shall be mounted on individual 3” panels.

    f) Circuits shall be labeled with 1.25” lettering. Circuit labeling shall be located on the front side of the plug-in outbox with white lettering on black background.

    g) Pigtail boxes shall support and include optional LED indicators to indicate the presence of power at each local circuit. The LED indicator shall be red in color and mounted in the cover plate directly below the circuit label for pigtail circuits.

8. Plug-in outlet boxes power distribution equipment shall be Underwriter Laboratories (UL) LISTED. Plug-in pigtail outlet boxes shall be the Electronic Theatre Controls, Inc. 9300 Series or equal (for surface or pipe mounting).

D. CONNECTOR STRIP—DISTRO shall be furnished and installed where shown on drawings

    1. Circuit wiring shall be supplied to the trough via an ETC Pantograph cable management system.

    2. Cable management shall utilize an ETC Prodigy pantograph that allows up to sixteen line-voltage circuits or a combination of line–voltage and up to two emergency circuits. Knockouts located 6” on-center are built into the raceway. The knockouts permit installation of houselights with canopy or stem mounts to attach directly to the raceway. Up to 50 pounds may be suspended between raceway supports.

    3. Pantograph cable management and houselight distribution is UL LISTED for

use with flat cable circuit distribution and fixture mounting as described above.

4. The load circuits and data wiring shall be fed to the distribution trough by one or more UL Listed Pantograph cable management systems that are specifically designed to interface with traditional stage distribution raceways. The pantograph shall allow the cable trays, feeder cable and data wiring to fold and store along the top of the connector strip without imposing a direct physical load on the connector strip.

5. The pantograph shall consist of a series of 18 ga. ventilated steel trays hinged to each other to allow the entire distance of travel required by the batten, up to 50'. The hinges and hinge attachment points shall be stiffened to prevent distortion of the pantograph.

6. The trays shall be connected to a moving trolley at the compression tube that allows relief as the system moves slightly from side to side during ascent/descent of the batten. At the bottom, the pantograph shall be attached to a hinge point above the houselight or distribution trough in a manner that imposes no additional physical load on those assemblies. The flat cable in the trays shall exit the pantograph and enter a termination box on the distro strip where all electrical connections shall be made.

7. The flat cable shall be UL LISTED.

8. The pantograph shall support a double-high/double wide stack of flat cable and shall allow the flat cable to bend at each joint within required NEC bending radii.

9. The trays shall hinge open/closed as the batten is lowered/raised and shall not impede the movement of the line set

10. The trays shall be sufficiently stiff to support themselves and the flat cable they carry. At no time shall the trays bow, warp, sag or twist whether or not under load of the flat cable.

11. Flat cable in the pantograph tray shall never heat in excess of the rated temperature maximum of the flat cable when all circuits within the tray are loaded at maximum electrical capacity.

12. It shall be possible to provide power for up to sixteen 20 amp circuits plus ground and data via each pantograph.

13. These cable management systems shall interface with the circuit distribution trough with standard mechanical and electrical hardware purpose designed for this assembly.

14. Hoisting systems utilizing cable management systems from third-party vendors shall be fully integrated into the hoisting system without additional custom hardware, changes to any part of the pantograph or changes to the QuickTouch controller.

15. Hoisting systems that do not fully integrate cable management in the hoisting system and controller shall not be acceptable for this installation

XVIII. THEATRICAL LIGHTING INSTRUMENT PACKAGE

A. Theatrical lighting instruments manufactured by Electronic Theatre Controls, Inc. are specified herein to provide a basis of quality. Other acceptable manufacturers are ALTMAN and STRAND LIGHTING, INC.

1. Followspot lighting instruments shall be manufactured by STRONG ENTERTAINMENT LIGHTING or LYCIAN.

B. Theatrical lighting instruments shall be capable of performing with tungsten halogen lamps or light emitting diodes (LED) as indicated herein with proper heat sink cooling. Phenolic materials shall be employed on the fixtures in order to protect the operator from potential burns.

C. Each theatrical lighting instrument shall be supplied with a malleable iron clamp to grip up to a two (2) inch ID pipe, a fixture yoke with locking clutch handle, and three (3) foot long SF2 leads in a fiberglass sleeve.

D. Minimum performance criterion for all theatrical lighting instruments shall be as herein specified. Each instrument shall be furnished with a three pole, grounded stage-pin male connector and safety cable. UL listing shall be required on all theatrical lighting instruments.

E. Ellipsoidal Reflector Spotlights (ERS):

1. The unit shall be constructed of rugged, die cast aluminum, free of burrs and pits, finished in black, high temperature epoxy paint. Tools shall not be required for either lamp alignment or cleaning the reflector or lens.

2. The ellipsoidal spotlights shall include:

a) Integral cable clamp for power leads.

b) Positive locking of lamp focus and independent lamp alignment controls.

c) High impact, thermally insulated knobs and shutter handles.

d) Reflector secured with shock mounts.

e) Lens secured with silicone shock mounts.

f) Shutter assembly shall allow for +/-25° rotation.

g) 20-gauge stainless steel shutters.

h) Insulated rear handle.

i) Interchangeable lens tubes for different field angles with Teflon guides for smooth tube movement.

j) Sturdy integral die cast gel frame holders with two accessory slots, and a top mounted, quick release gel frame retainer.

k) Rugged 3/16” x 1-1/4” steel yoke with two mounting positions allowing 300°+ rotation of the fixture within the yoke.

l) Positive locking, hand operated yoke clutch.

m) Slot with sliding cover for motorized pattern devices or optional iris.

3. The optical train shall combine a compact filament lamp with a precision molded borosilicate, ellipsoidal reflector and aspheric lens to produce an optimum cosine field. The unit shall provide, but not be limited to:

a) Molded borosilicate reflector with multiple dichroic layers.

b) 95% of visible light shall be reflected while 90% of infrared light as heat shall be transmitted through the reflector.

c) Low gate and beam temperature.

d) Sharp imaging through a three-plane shutter design.

e) Projector-quality, high contrast aspheric lens, with an anti- reflective coating to increase transmission.

4. The unit shall be precision engineered to use an HPL lamp to deliver an even, intense field with cosine distribution. The unit shall provide, but not be limited to:

a) 5, 10, 14, 19, 26, 36, 50, 70 and 90-degree field angles.

b) High-quality pattern imaging.

c) Sharp shutter cuts without halation.

d) Shutter warping and burnout in normal use shall be unacceptable.

e) Adjustable hard and soft beam edges.

f) The unit shall be capable of utilizing ETC Dimmer Doubling technology.

g) The unit shall be UL and cUL listed and so labeled.

h) 19, 26, 36, and 50 degree units shall have optional lens tubes available for precision, high-contrast imaging.

5. The high efficiency lamp shall be an HPL lamp, which shall consist of a compact tungsten filament contained in a krypton-filled quartz envelope. The lamp shall

mount axially within the reflector. The lamp base shall have an integral die cast aluminum heat sink that reduces seal temperature and ensures proper lamp alignment. The lamp socket shall be ATP 220 nickel gold plated.

6. The Theatrical Lighting Instruments shall be ETC Source 4 ELLIPSOIDAL.

7. This Contractor shall furnish the following types and quantities of ERS instruments with lamp, gel holder, C-clamp, and safety chain:

    a) Fourteen (14) 14-degree fixed focus ERS's, ETC 414.

    b) Twenty-two (22) 19-degree fixed focus ERS's, ETC 419.

    c) Thirty-eight (38) 26-degree fixed focus ERS's, ETC 426.

F. Fresnel Spotlights:

1. The unit shall be constructed of rugged, die cast aluminum, free of burrs and pits, finished in black, high temperature paint.

2. The unit shall be nominally 12.5" long x 9.5" wide and weigh 13.25 lbs. without the "C" clamp.

3. The fresnel spotlights shall include:

    a) 36" power lead with bare-ends.

    b) Integral cable clamp for power leads.

    c) Sealed housing with no light leaks.

    d) Zoom adjustment by means of a large, side-mounted knob with integral locking lever.

    e) Bottom-access lamp removal.

    f) Lamp socket access door shall use a tool-free ¼-turn closure device.

    g) Two accessory slots and a top mounted locking door for gel frames and beam control accessories.

        (1) Accessory slots shall be completely surrounded by a rugged metal housing for elimination of light leaks around gel frames and other beam control accessories.

        (2) Accessory slots shall be compatible with 7.5" beam control accessories, i.e. barn doors, gel frames, top hats, etc., such as used by Source Four PAR luminaires and other similarly-sized fixtures.

    h) Rugged steel yoke.

i) Adjustable yoke mounting position for variable fixture balance point.

j) Positive locking, hand operated yoke clutch.

k) Large, rugged handle on rear of fixture.

l) Integrated safety cable mounting ring.

m) Color frame.

4. Optical:

a) Units shall use a Fresnel lens and provide soft-edged, but well- defined beam shaping with a barn door attachment.

b) Luminaire shall provide a field angle zoom range of 20 degrees to 65 degrees.

c) The optical train shall utilize a compact filament lamp with a modified spherical reflector.

d) The luminaire shall output no less than 10,000 field lumens in full flood setting when fitted with 750W, 115V high out-put HPL lamp.

e) Luminaires producing less than 10,000 field lumens in full flood setting with a 750W lamp shall not be acceptable.

f) Reflector shall be molded borosilicate glass with multiple dichroic layers.

g) Reflector efficiency shall be a minimum of 93%.

h) Reflectors of pressed aluminum or other sheet metal construction shall not be acceptable.

5. The unit shall utilize only the HPL lamp, which shall consist of a compact tungsten filament contained in a krypton-filled quartz envelope. The lamp base shall have an integral die cast aluminum heat sink that reduces seal temperature and ensures proper lamp alignment. The lamp socket shall be ATP 220 nickel gold plated.

a) The lamp shall be pre-focused in relation to the reflector.

b) The lamp shall be removable from the bottom of the fixture for re-lamping.

6. The Theatrical Lighting Instruments shall be ETC Source 4 Fresnel units (7064A1001-0X).

7. This Contractor shall furnish the following types and quantities of FRESNEL

instruments with lamp, gel holder, C-clamp, and safety chain:

a) Twenty (20) ETC Source 4 Fresnel instruments.

G. Color Mixing Light Emitting Diode (LED) Wash Fixtures:

1. The lighting instruments (fixture) shall be a color-mixing high-intensity LED illuminator with DMX control of intensity and color. The fixtures shall be Desire D40 and D40 Studio as manufactured by Electronics Theatre Controls, Inc. or approved equal.

2. The LED lighting instrument shall be UL 1573 listed for stage and studio use and shall comply with USITT DMX-512 A standard.

3. The LED lighting instrument shall be contained in a rugged all-metal die- cast housing, free of burrs and pits and shall have a black powder coat finish. Power supply, cooling and electronics shall be integral to each unit.

4. The LED lighting instrument shall have two (2) easy-access slots for secondary lenses and other accessories. The slots shall be equipped with locking retaining clips.

5. The LED lighting instrument shall include, but not be limited to:

a) Theatrical –style hanging yoke.

b) 25 deg. secondary lens.

c) Five (5) foot power lead with grounded stage-pin connector.

d) Yoke with floor stand conversion feature.

e) PowerCon to PowerCon cables for fixture power wiring.

f) Multiple secondary lens options to include multiple angles in the following patterns:

(1) Linear

(2) Round

(3) Oblong

6. Light output shall be via a round aperture. Aperture and accessory slots shall accommodate standard 7.5” accessories such as used in other similar-sized fixtures. Accessories available as options shall include but not be limited to:

a) Gel/diffusion frames

b) Top hats

c) Barndoors

d) Egg crate louvers

e) Concentric ring louvers

f) Multiple secondary lensing options

7. Thermal:

a) The fixture shall be totally convection cooled, requiring no cooling fan. Fixtures which require an on-board cooling fan shall not be acceptable unless pre-approved.

b) The fixture shall utilize advanced thermal management systems to maintain LED life to an average of 70% intensity after 50,000 hours of use.

8. Thermal management shall include multiple temperature sensors within the housing to include:

a) LED array circuit board temperatures.

b) Temperature sensors placed on each individual LED color circuit.

c) Fixture ambient.

d) CPU.

9. Fixture user shall permit monitoring of temperature sensors via a legible LCD multi-line backlit display.

10. Fixtures that do not provide active thermal monitoring of LED circuits and other temperature readings shall not be acceptable.

a) The fixture shall operate in an ambient temperature range of - 20°C (-4°F) minimum, to 40° C (104°F) maximum ambient temperature.

11. Electrical:

a) The fixture shall be equipped with 100V to 240V 50/60 Hz internal power supply.

b) The fixture shall support power in and thru operation.

(1) Power in shall be via Neutrik® PowerCon™ input connector.

(2) Power thru shall be via Neutrik ® PowerCon ™ output connector.

(3) Fixture power wiring and accessory power cables shall be rated

to support linking of multiple fixtures up to the capacity of a 15A breaker.

c) The fixture requires power from non-dim source.

d) Power supply outputs shall have self-resetting current limiting protection.

e) Power supply shall have power factor correction.

12. LED Emitters:

a) The fixture shall contain a minimum of 5 different LED colors to provide color characteristics as hereinafter described.

b) All LEDs used in the fixture shall be high brightness and proven quality from established and reputable LED manufacturers.

(1) Fixture shall utilize Luxeon® Rebel™ LED emitters.

c) Manufacturer of LED emitters shall utilize an advanced production LED binning process to maintain color consistency.

d) LED emitters should be rated for nominal 50,000 hour LED life to 70% intensity.

e) All LED fixtures (100% of each lot) shall undergo a minimum eight-hour burn-in test during manufacturing.

13. Calibration – Fixtures shall be calibrated at factory the for achieve consistent color and intensity output between fixtures built at different times and/or from different LED lots or bins.

a) Calibration data shall be stored on the LED array as a permanent part of on-board operating system.

b) All arrays, including replacement arrays shall be calibrated to the same standard to insure consistency.

c) Fixtures not offering LED calibration shall not be acceptable.

14. Color – The fixture shall utilize a minimum of 40 LED emitters. The fixture shall be available in specialized LED arrays as outlined below:

a) DESIRE D40

(1) Red, Amber, Green, Cyan, Blue, Indigo and White LEDs in an array designed for broad spectrum color, light tints, and variable whites. This array shall be the Lustr+ array as manufactured by Electronic Theatre Controls, or approved equal.

b) Measured brightness of the Lustr+ array shall be greater than 2900 field lumens

(1) Red, Orange, Amber, Green, Cyan, Blue and Indigo LEDs in an array designed for broad spectrum deep colors. This array shall be the Vivid array as manufactured by Electronic Theatre Controls, or approved equal.

c) Measured brightness of the Vivid array shall be greater than 2500 field lumens.

(1) Red, Orange, Amber, Green and Indigo LEDs in an array designed for extra-high brightness output in red/warm end of the spectrum. This shall be the Fire array as manufactured by Electronic Theatre Controls, or approved equal.

d) Measured brightness of the Fire array shall be greater than 2500 field lumens.

(1) Red, Orange, Green, Cyan, Blue and Indigo LEDs in an array designed for extra-high brightness output in the blue/cool end of the spectrum. This shall be the Ice array as manufactured by Electronic Theatre Controls, or approved equal.

e) Measured brightness of the Ice array shall be greater than 1800 field lumens.

15. Dimming:

a) The LED system shall use 15-bit nonlinear scaling techniques for high-resolution dimming. At least four different dimming curve options shall be accessible at the fixture's User Interface.

(1) Incandescent

(2) Standard

(3) Linear

(4) Quick

b) Dimming curves shall be optimized for smooth dimming over longer timed fades.

c) The LED system shall be digitally driven using high-speed pulse width modulation (PWM).

d) LED control shall be compatible with broadcast equipment in the following ways:

(1) PWM control of LED levels shall be imperceptible to video cameras and related equipment.

(2) PWM rates shall be adjustable by the user at the fixture if necessary to avoid any visible interference to video cameras and related equipment.

16. Control and User Interface:

a) The fixture shall be USITT DMX 512A-compatible via In and Thru 5-pin XLR connectors.

b) The fixture shall be compatible with the ANSI RDM E1.20 standard.

(1) All fixture functions shall accessible via RDM protocol for modification from suitably equipped control console.

(2) Temperature sensors within the luminaire shall be viewable in real time via RDM.

(3) Fixtures not offering RDM compatibility, feature set access or temperature monitoring via RDM shall not be compatible.

c) The fixture shall be equipped with multi-line LCD display for easy-to-read status reports and configuration changes.

d) The fixture shall be equipped with a six-button user-interface.

e) The fixture shall offer multiple DMX input profile options to include:

(1) RGB – control of all individual LED colors via a three- channel profile.

f) Red, Green, Blue.

(1) HIS – control of all individual LED colors via a three- channel profile.

g) Hue, Saturation, and Intensity.

(1) HSIC – control of all LED colors via a four-channel profile.

h) Hue, Saturation, Intensity and Color Point.

i) Color point provides variable color temperature settings.

(1) Direct – control of each individual color channel via an independent channel.

(2) A variable-rate strobe channel shall be provided.

j) The fixture shall offer three output setting:

(1) Boost mode - powers LEDs at maximum intensity and provides no compensation against LED ‘droop’ or intensity loss.

(2) Regulated mode – slightly restricts maximum LED intensity levels to compensate against LED droop.

(3) Protected mode – further restricts maximum LED intensity levels to compensate against LED droop and offer color consistency at highest permissible ambient temperatures (40C).

(4) Fixtures that do not provide regulated and protected operation modes are not acceptable.

k) The fixture shall offer additional user-definable options to including but not limited to:

(1) Display time out options.

(2) Loss of data behavior options.

(3) White point settings.

(4) Red-shift option for tungsten dimming emulation.

l) The fixture shall offer five Quick Set-Ups to allow user to rapidly select different combinations of the numerous user options based on the desired usage situation, to include:

(1) General – for most situations.

(2) Stage – when emulating incandescent fixtures is desired.

(3) High Impact – when maximum output and effect is desired.

(4) XT Arch – when color consistency and architectural characteristics are desired.

(5) Studio - when DMX or stand-alone of white light output is required with intensity, color temperature and color tint control parameters.

m) The fixture shall offer stand-alone functionality eliminating the need for a console.

(1) Fixture shall ship with 24 preset colors accessible as a stand-alone feature.

(2) Fixture shall ship with 12 Sequences accessible as a stand-alone feature.

(3) Each color and sequence can be modified by the end user.

(4) Fixtures can be linked together with standard DMX cables and controlled from designated master fixture.

n) Up to 32 fixtures may be linked.

(1) Fixtures in a stand-alone state shall restore to the settings present prior to power cycling, eliminating the need for reprogramming.

(2) Fixtures without stand-alone operation features described in a, b, c, d, and e shall not be acceptable.

17. The Theatrical Lighting Instruments shall be ETC D40 LED lighting instruments. This Contractor shall furnish the following types and quantities of LED lighting instruments with C-clamp, safety chain, full lens sets, 5' DMX cables, and 10' PowerCon Jumper Cables:

a) Twenty-four (24) Desire D40™.

H. 2.5 Watt Color Mixing LED Fixtures (Cyc Lights):

1. The LED lighting instruments (fixture) shall be a color-mixing LED fixture with DMX control of intensity as well as color changing. The fixture shall be a Vivid as manufactured by Electronics Theatre Controls, Inc. or approved equal.

2. The LED lighting instrument shall be ETL listed to UL 1573 and shall comply with USITT DMX-512 A standard.

3. The LED lighting instrument shall be contained in a rugged all-metal die- cast housing, free of burrs and pits and shall have a black powder coat finish. Power supply, cooling and electronics shall be integral to each unit.

4. The LED lighting instrument shall utilize advanced thermal management systems for long LED life and shall be designed to transfer heat from the LED board to the outside environment.

5. The LED lighting instrument shall have easy-access slots for secondary lenses and varied beam spreads. The slots shall be equipped with locking retaining clips.

6. The LED lighting instrument shall be provided with:

a) 1/2" Mounting bolts on each end.

b) Five (5) foot power lead with grounded stage-pin connector.

c) Yoke, c-clamp, and 25’ DMX cable

d) Lens set of 2 lenses

7. The unit shall be:

a) 21.5 inches (547mm) long by 7.1 inches (180mm) high by 6.5 inches (165mm) deep with a weight of 20 lbs (9.1 kg) not including mounting hardware.

8. Electrical:

a) The fixture shall be equipped with 100V to 240V 50/60 Hz internal power supply.

b) The fixture shall receive power via Neutrik® PowerCon™ input connector.

c) The fixture requires power from non-dim source.

d) Power/data supply outputs shall have current limiting protection.

e) Power/data supply shall provide miswiring protection.

f) Power/data supply shall have power factor correction.

g) Power/data supply shall be UL listed for Class 1 or Class 2 wiring.

9. LED Emitters:

a) The fixture shall utilize red, red-orange, amber, green, cyan, blue, and indigo emitters for maximum spectral output.

b) All LEDs used in the LED fixture shall be high brightness and proven quality from established and reputable LED manufacturers.

c) Manufacturer of LED systems shall utilize an advanced production LED binning process to maintain color consistency.

d) LED emitters should be rated for nominal 50,000 hour LED life.

e) Fixture shall utilize the ETC’s Vivid-R 2.5W Rebel LED emitters.

f) All LED fixtures (100% of each lot) shall undergo a minimum eight-hour burn-in test during manufacturing.

10. Color:

a) Each 11” cell shall contain 40 LEDs with seven (7) different colors of LED emitters for a spectral output using the ETC x7 Color System™ 7-color array.

b) The fixture shall be optimized for excellent pastel and saturated colors.

c) The LED system shall be capable of at least 15-bit control of each color level in each cell for greater than 1 billion possible color combinations.

d) The fixture shall interact seamlessly with conventional sources.

e) The fixture shall render light tints and skin tones similar to tungsten-sourced fixtures.

11. Control:

a) Each 11” cell of every fixture shall have the capability to be set to a unique and individual address.

12. 21” fixture provides 2 independently controlled cells.

a) The fixture shall be DMX 512 compatible via In and Thru 5-pin XLR connectors.

b) The LED system shall be digitally driven using high-speed pulse width modulation (PWM).

c) LED control shall be compatible to broadcast equipment.

(1) PWM control of LED levels shall be imperceptible to video cameras and related equipment.

d) Each 11” cell of every fixture shall provide 8 channel control (7 color plus intensity).

(1) An intensity channel shall be utilized for each cell to minimize color shift during dimming.

e) The LED system shall use 15-bit nonlinear scaling techniques for high-resolution dimming.

f) Dimming curves shall be optimized for smooth dimming at low intensities and over longer timed fades.

13. The Theatrical Lighting Instruments shall be ETC Selador Vivid-R LED lighting instruments. This Contractor shall furnish the following types and quantities of LED lighting instruments with hanging hardware, safety chains, and 25’ DMX cables:

a) Eighteen (18) 21” Selador Vivid-R LED lighting instruments.

I. Followspots:

1. The followspot unit frame and enclosure shall be constructed of formed cold

rolled steel and sturdy aluminum extrusions, free of burrs and protected by a black powder coat finish.

a) Handles shall be provided to facilitate smooth operation and to lift the unit.

b) The unit shall be mounted on a stable, folding three-point floor stand.

c) Mounting shall incorporate the following design features:

(1) Unobstructed access;

(2) Easy height adjustments;

(3) Horizontal Pan and Vertical Tilt Control Levers.

d) The Power Supply shall be separate from the followspot in order to maintain quiet and efficient cooling and to facilitate maintenance, repair or replacement of the Power Supply. Follwspots containing internal power supplies shall not be acceptable.

e) A sliding panel shall provide access to lenses without the use of tools.

f) Weight of Head unit shall not exceed 37 pounds.

g) Length of head unit with color changing boomerang shall not exceed 41”.

2. Controls:

a) The lamp housing shall, as a minimum incorporate the following:

(1) Quiet forced-air cooling by internally wired blower.

(2) Remote ON/OFF fan control.

(3) Drop-down single ended lamp holder to permit bulb replacement without the use of hand tools.

(4) Bulb positioning controls.

b) The body of the unit shall, as minimum incorporate the following:

(1) Optical dimmer iris mechanism for smooth manual dimming.

(2) Four shutters mounted on two planes, for both vertical and horizontal masking

(3) Drop-in nichrome steel Iris and Gobo holder.

(4) Zoom focus controls with calibrations silk screened on

followspot body.

c) With the iris fully open the followspot shall be capable of producing a continuous range of field angles from 8.0 degrees in spot to 22 degrees in flood.

d) At any field angle the beam shall be adjustable between soft and sharp edges.

e) The front of the unit shall house a five (5) color, self-canceling boomerang with color filters.

3. Optical:

a) The unit's optical train shall consist of:

(1) Socket mounted 700 watt single-ended metal halide lamp.

(2) Fixed optical quality glass reflector and double condenser lens.

(3) Variable focus lens system utilizing Optical-quality glass.

(4) Iris/Gobo holder, and shutters for beam shaping control.

(5) Five color boomerang.

b) The zoom focus shall increase light intensity as it decreases the spot diameter.

c) The light Color Temperature shall be 6,000 ° K with Philips MSD 700 (3,300-hour lamp)

4. Electrical:

a) Metal halide lamp system input shall be 110-120V.AC, 50/60 Hertz, single phase.

b) Power Supply shall be separate from spotlight unit and easily interchanged.

c) A double microswitch interlock shall be provided for safe lamp replacement.

5. Performance:

a) Adjusted for flat field (approximately 70%) the unit shall produce a continuous range of illumination from 270,000 beam candlepower in Flood focus to 1,123,000 beam candlepower in Spot focus.

b) The Field diameter at a 60-foot throw shall be continuously adjustable from 15.8 feet in Flood focus to 6.3 feet in Spot focus. With full iris the

Field diameter in spot focus shall be 15”.

6. This Contractor shall furnish the following followspot lighting instruments complete with Lamp, Iris, Gobo Holder, Color Changer, Stand and all necessary accessories.

    a) Two (2) STRONG LIGHTING Canto 700 followspots (10707080).

Part 3 - Execution

I. INSTALLATION

A. All wiring for the house and stage lighting control system shall be run in conduit and flexible multi-conductor cables as hereinbefore specified. All junction box covers shall be identified as hereinbefore specified. All conduit, device mounting boxes, junction boxes, and enclosures shall be securely fastened with appropriate fittings to ensure positive ground throughout the entire system.

B. This Contractor shall furnish and install all wiring and make all final connections as indicated in the system manufacturer’s shop drawings and standard installation documents. Splices for dimming circuits shall be made only in junction boxes.

C. All wiring shall be checked and tested by this Contractor to ensure the system is free from grounds, opens, and shorts.

D. It shall be the responsibility of the Contractor performing the work in this section to coordinate with the stage rigging system Contractor for the proper installation and operation of the stage lighting, wiring devices, cables, supports, etc.

E. All work shall be under the supervision of a field engineering technician, accredited by the system manufacturer. It shall be the responsibility of this technician to check and inspect the installation to the Owner's and Architect/Engineer's satisfaction. This technician shall perform the initial programming of the system with direction and coordination with the Owner.

II. SYSTEMS INTERFACE AND PROGRAMMING MODIFICATIONS

A. A Fire Alarm Interface module shall be furnished and installed by this Contractor. Upon activation of the buildings Fire Alarm and Detection System the auditorium house lights, including emergency lights controlled by the dimmer system, shall be programmed to automatically be restored to full brightness. Refer to Specifications Section 16610, Fire Alarm and Detection System.

B. The Auditorium House Lights shall be programmed so that the dimmable house lighting loads will not exceed 90% of their full dimmable output during normal operations. A time clock function shall bring all dimmable tungsten halogen and incandescent house lighting loads to full 100% output for one hour during each one week cycle. The cycle shall occur on Wednesdays at 3:00 A.M., unless otherwise directed by the Owner. This cycle will help to extend the life of the tungsten halogen and incandescent lamps and burn off any carbon buildup on the tungsten halogen lamp envelope.

III. PERSONNEL TRAINING

A. A field engineering technician, accredited by the system manufacturer shall provide a minimum of eight (8) hours of training for the Owner's operating personnel on the proper operation and troubleshooting of the lighting control system equipment.

IV. OPERATING AND MAINTENANCE INSTRUCTIONS

A. At the completion of the installation, the manufacturer shall furnish four (4) final sets of "as-built" drawings as well as manuals of instruction as to the proper operation and maintenance of the lighting control system. Formal turn-on and instruction shall be provided to the Owner's officially designated representative within fourteen (14) days of a written request by the Owner.

B. This Contractor shall furnish the Owner's officially designated representative(s) with a minimum of eight (8) hours of on-the-job instructions in the operation, maintenance, and diagnostic testing of the system. (This shall not be part of the system turn-on specified above.) This Contractor shall also furnish the Architect/Engineer four (4) bound copies of complete operating and maintenance instruction manuals of the lighting control system including circuit diagrams and all other information necessary for proper operation and service maintenance.

V. SYSTEM TEST

A. This Contractor shall conduct an operating test of the complete system. The system shall test free from grounds, shorts, and other faults. All connections shall be thoroughly checked for mechanical and electrical connections. All lighting control system equipment shall be demonstrated to operate in accordance with the requirements set forth in these Specifications and as shown on the Drawings.

B. This Contractor shall perform all tests in the presence of the Architect/Engineer. This Contractor shall furnish all personnel and test instruments for use in the tests.

VI. WARRANTY

A. This Contractor shall deliver the work in a first-class operating condition in every respect.

B. This Contractor shall warrant that the material, equipment, and workmanship furnished shall be entirely free from defects. Any material, equipment, or workmanship in which defects may develop before or during the warranty period shall be repaired or replaced at the Contractor's own expense. Refer to SECTION 01740 for the start of the warranty period. The Contractor shall further warrant that all material, equipment, and workmanship used in the installation, but not specifically mentioned in the Drawings and Specifications, is the best of their respective kinds and that the construction and installation was performed in accordance with the best accepted standard practices in all details.

C. The lighting control system manufacturer shall be prepared to offer a service contract for the maintenance of the system after the warranty period.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include the materials and equipment necessary for this Contractor to furnish and install a performance lighting control system(s), wiring devices and performance lighting instruments herein specified for the middle school stage. It shall also include the services of qualified field engineer/technicians regularly employed by the manufacturer of the system(s) who shall review the installation(s) to ensure its proper operation and provide Owner training.

B. The Middle School Stage Performance Lighting Systems and Controls shall be furnished by a factory authorized Theatrical Contractor certified to design, program and service the systems. The Theatrical Contractor shall be responsible for coordination between the electrical installation and other trades installing theatrical equipment and for control terminations, system startup, system training, and warranty repair. A Theatrical Contractor is defined as a dealer who regularly engages in the sale and installation of theatrical supplies and equipment. The Theatrical Contractor must show evidence of successfully furnishing theatrical systems specified for at least five (5) years.

C. This Contractor shall furnish and install all necessary equipment as hereinafter detailed for a complete and functional performance lighting control system(s) including the theatrical lighting instruments. Although not every component is called out in every detail, it shall be the responsibility of the manufacturer providing the system to assure that the intended function is furnished.

D. The system specified herein shall consist of a dimmer-per-circuit high density dimming system equipment panel, performance lighting control console, network based signal distribution system, distribution equipment, performance lighting instruments, and all required interconnecting wiring.

E. This Contractor shall furnish and install in accordance with the lighting control manufacturer's instructions, all conduits, wiring, and outlet boxes required for the erection and operation of the complete system(s) as herein specified and as shown on the Drawings.

F. The performance lighting control system shall be supplied as a single integral unit with all dimmer modules, control circuits, circuit breakers, and the like factory wired. Field wiring shall consist of connecting input feeders, dimmer circuits, and remote control wiring to the distribution devices and control console.

G. It is the intention of this specification section that the entire Middle School Stage performance lighting control system be available to all bidders and not “Packaged or Bundled” with any other lighting systems or equipment.

III. QUALITY ASSURANCE

A. The contractor shall furnish submittals for all components of the performance lighting and lighting control system(s) in accordance with SECTION 16010 of these Specifications. The submittals should include the manufacturers working drawings and shall include, but not be limited to the following:

1. Manufacturer's catalog data for all lighting instruments, equipment, and components that shall include all technical data to demonstrate conformance with these Specifications.

2. Complete physical drawings of all items of equipment showing dimensions, metal gauges, etc.

3. Complete load schedules which shall clearly indicate actual connected loads and control channel assignment (where applicable), cross- reference of internal equipment identifications to circuit numbers shown on the Drawings, and all other scheduled information which shall relate the equipment to the project requirements.

4. Complete internal and interconnection wiring diagrams showing number, size, and types of conductors between equipment and from equipment to loads, and feeder quantity and sizes.

B. The lighting control system equipment specified herein shall be the sole responsibility of a single manufacturer. The manufacturer shall have been producing theatrical lighting and SCR type lighting control systems for at least fifteen (15) years.

C. All work shall be in accordance with good engineering practices. All equipment for this system shall be listed by Underwriter's Laboratories, Inc. (UL), bear the UL label, and shall be installed in accordance with all requirements of the National Electrical Code (NEC), state and local codes, and these Specifications.

D. The entire performance lighting control system shall be completely factory assembled and tested under load conditions prior to shipment of the system.

IV. QUALIFICATIONS

A. The Contractor and the Theatrical Contractor/Distributor shall be required to furnish satisfactory proof of their competence as evidenced by successfully completed previous contracts where control equipment of this nature has been specified.

B. The Contractor is encouraged to visit the site, shall become familiar with the Drawings outlining this work, and shall become completely familiar with the various items of

equipment being furnished under other Divisions of these Specifications related to this work. The Contractor shall make all necessary investigations relative to the conditions that may be encountered on this project.

V. SPARE PARTS

A. This Contractor shall furnish to the Owner spare parts as follows. Spare parts shall be furnished prior to the installation of the system.

1. One (1) D20AFTR dimmer module.

2. One (1) spare dimmer rack processor. (Control Modules) with Smartlink Processor

B. This Contractor shall furnish to the Owner, at the completion of the project, 20% (minimum of two) spare lamps for each type and wattage of lamps used in the theatrical lighting instruments.

Part 2 - Products

I. MANUFACTURERS

A. The house and stage lighting control system as shown on the Drawings and herein specified shall be as manufactured by ELECTRONIC THEATRE CONTROLS, INC. (ETC) [Sensor3™ System] as listed or the equivalent as manufactured by STRAND LIGHTING, INC. [C21 System] which must meet all of the requirements of these Specifications. The system shall utilize the manufacturer's standard products and components with modifications as required meeting the construction and performance requirements of this section.

B. The theatrical lighting instruments as shown on the drawings and herein specified shall be as manufactured by ELECTRONIC THEATER CONTROLS INC. (ETC), and STRONG ENTERTAINMENT LIGHTING (followspots) as listed or the equivalents as manufactured by STRAND LIGHTING, INC., ALTMAN Canto, or LYCIAN which must meet all of the construction and performance requirements of these specifications.

II. DIMMING SYSTEM EQUIPMENT RACK

A. This Contractor shall furnish and install where shown on the Drawings, a house and stage lighting dimming system equipment rack(s). The racks shall be the ETC Sensor3 SR3-24 (24 module) Advanced Features dimmer rack.

B. Dimmer Rack Electrical:

1. The dimming system equipment rack shall be suitable for operation at 120/208 volt, three phase, four wire, + ground, sixty hertz, 400 amp, and have busing rated for 100% continuous duty, and suitable lugs for a single point connection. Sensor racks shall automatically compensate for frequency variations during operation. Standard SCCR fault current protection shall be 100,000A. The rack

shall have a bus kit provided by the manufacturer to allow adjacent racks to be powered by a single feed. Racks shall be UL listed with appropriate factory applied labels.

2. Load and neutral terminals shall be sized to accept up to three (3) sets of 500 kcmil conductors or other sizes and/or quantities as shown on the Drawings.

3. Load terminals shall be located at the front of the wiring cavity. Front access racks having terminals located at the back of the rack or on the side near the back of the rack such that adjacent load cabling may block terminal access shall not be acceptable.

C. Dimmer Rack Electronics:

1. Power control electronics (CEM3) shall be contained in a single module that must be plug-in capable without use of tools.

2. All data and power input for CEM3 control electronics shall be located on a separately removable/pluggable termination connector on the backplane such that backplane can be replaced without removal and discrete secondary conductor terminations. Dimming systems that require discrete termination of DMX, Ethernet, power input, and dimmer control output directly on terminals on the control module or pluggable backplane shall not be permitted.

3. The power controller shall directly support the following network protocols:

   a) Net3 protocol suite including ANSI E1.31 Streaming ACN (sACN)

   b) b. ANSI E1.17 Architecture for Control Networks (ACN)

4. Systems must support the above listed industry standard ACN protocols for Ethernet setup, control and feedback integrated directly between the power system and control system.

5. The power controller shall directly support 2 ports of control input using ANSI E1.11 USITT DMX512-A.

6. Dimming control signals must be sent between control module and dimmer/power modules using flat ribbon cables.

7. System must provide an optional low voltage connection to maintain power of control electronics through brown out, instantaneous, and sustained power outages.

8. Control electronics shall be housed in a formed steel body with cast- aluminum face panel.

D. Physical:

1. The Sensor3 dimmer rack shall be a free-standing, dead-front switchboard, substantially framed and enclosed with 16 gauge, formed steel panels. All rack components shall be properly treated, primed and finished. Exterior surfaces shall be finished in fine-texture, scratch- resistant, gray epoxy paint. Removable top and bottom panels shall facilitate conduit termination on the rack.

2. Rack components shall be designed for easy removal and installation so that the dimming system equipment rack is completely open and empty during field wiring. Rear access to the rack for installation or servicing shall not be required. Racks shall be designed for front access to allow back-to-back, back-to-wall or side-by-side installation.

3. Racks shall be designed to allow easy insertion and removal of all modules without the use of tools. Supports shall be provided for precise alignment of dimmer modules into power and signal connector blocks. With modules removed, racks must provide clear front access to all load, neutral and control terminations.

4. Module spaces shall be mechanically keyed to accept only the 3kW or below, 5kW, or 10kW module specified for that space. The rack shall be configurable to accept mixed dimmer types and sizes throughout the rack.

5. Each rack shall provide a lockable full-height door containing an integral electrostatic air filter that shall be removable for easy cleaning. A single low-noise fan shall be located at the top of each rack. Design of the rack and dimmer modules shall draw all cool air intake air through the integral electrostatic air filter at the front of the rack, discretely through each module housing and directly out the top of the rack such that exhausted hot air from adjacent modules does not heat the module(s) above, below, or to the side of each other.

6. The fan shall maintain the temperature of all components at proper operating levels with dimmers under full load, provided the ambient temperature of the dimmer room does not exceed 40°C/104°F. Dimmer racks that do not employ both locking doors and electrostatic air filters shall not be acceptable.

7. The fan shall turn on whenever any dimmer in the system is activated. In the event of an over-temperature condition, only the affected dimmer module(s) shall shut down and a message shall appear on the control module LCD. The fan shall remain on during thermal shutdown of individual dimmer modules. Systems must include over-temperature sensing and preventative thermal shutdown.

8. A fan sensor shall be provided. In the event of momentary fan failure, error message will be displayed and sent remotely over Ethernet to optional logging systems. Systems must provide optional system event logging.

9. If the ambient room temperature drops below 0°C/32°F or rises above 40°C/104°F, a warning shall appear on the dimmer rack LCD. If the temperature rises above 46°C/115°F, the rack shall shut down until the condition is corrected.

10. A 3 x 0.5-inch LED status indicator (beacon) shall be mounted in the rack door. The beacon shall be visible throughout a wide viewing angle. In normal operating conditions, this LED is illuminated. If the rack's control module senses an error condition, the beacon shall flash until the error is corrected. An optional indicator shall be available for remote locations. Racks must have external means of visually showing that an error is present.

E. Provide one (1) SR3AF 24 Advanced Features Dimmer racks.

1. Provide an engraved nameplate on the front face of the dimmer rack in a suitable location. The nameplate shall be lettered HOUSE AND STAGE LIGHTING THEATRICAL DIMMING RACK

III. POWER CONTROL ELECTRONICS

A. The dimmer rack electronics shall be contained in one plug-in CEM3 Power Controller. Each power controller shall plug into the dimming cabinet with no need for tools or discrete wire connections. A simple user interface shall be provided for group configuration, testing and diagnostics. Power control shall be UL/cUL Listed and CE Marked. Removal of Power and Dimming Control electronics must be a tool free process.

1. The control electronics shall be contained in one plug-in module, housed in a formed steel body with cast-aluminum face panel, and self-retaining ejection handles to ease removal from the rack.

2. The power control shall automatically compensate for frequency variations during operation.

B. Power Control Interface:

1. A backlit eight-line by 20-character graphical LCD shall be provided for system configuration, live control, and status display.

2. The following functional features shall be available in power control to reduce setup and tech times:

a) Full number pad shall be provided for quick access to dimmers. Power Control must provide 0-9 number pad and logic keys for AND, THRU, and AT for fast access, selection, and control of circuit/dimmer number.

b) Power control shall provide NEXT and LAST buttons to progress through circuits/dimmers during dimmer check operations such that

only a single circuit is brought on to a level at a time during pre-show lighting checks for lamp burnouts.

c) Shortcut buttons for Setup, About, and live control shall be provided for separation of functionality such that a user intending to check status or settings does not accidentally render their system unusable. These buttons shall also serve to reduce maximum time to access any feature or setting on a single dimmer, range of dimmers, or entire rack.

3. The front panel shall have five status LED indicators: power, network activity, DMX A, DMX B, and panic state.

4. Power control must include the above buttons and features.

C. Control Signal and Communications:

1. The power control shall be provided with an Ethernet control signal input. This input shall be fully configurable with a range of patching and priority programming capabilities. The Ethernet signal shall supply seamless integration between the dimmer racks and both the entertainment and architectural lighting control systems. The Ethernet signal shall also enable remote configuration, playback, file storage and monitoring features on a personal computer on the network. Dimming systems that require Ethernet to DMX translation devices for control of critical show lighting introduce a potential failure point and shall not be acceptable.

2. All data and power input for CEM3 control electronics shall be located on a separately removable/pluggable termination connector on the backplane such that the backplane can be replaced without removal and discrete secondary conductor terminations. Systems must support tool- less and not require removal of wires connected directly to the control electronics.

3. DMX connections shall be available with option for pluggable screw or punch-down type terminal. Systems must allow this option to support both DMX over CAT5 and multi-strand conductors.

4. Ethernet connection shall be available via standard Cat5 RJ45 connection. System requiring punch down direct to rack or controller cannot be Cat5 system certified and shall not be acceptable.

5. Dimming systems that require discrete termination of DMX, Ethernet, power input, and dimmer control output directly on terminals on the power control or pluggable backplane shall not be acceptable.

6. The following options shall be provided to backup all controller setup UL924 Panic configuration, and recorded presets:

a) Automatic backup in non-volatile backplane memory.

b) Automatic backup in non-volatile Controller memory.

c) USB storage device pluggable on the controller face panel.

d) Data shall also be transferable to and from library storage on a personal computer on a per-rack basis.

7. The power controller shall directly support the following network protocols:

a) Net3 protocol suite including ANSI E1.31 Streaming ACN (sACN).

b) ANSI E1.17 Architecture for Control Networks (ACN).

8. The power control shall directly support two (2) optically isolated ports of ANSI E1.11 USITT DMX512-A for control input. Minimum 2,500V of optical isolation shall be provided between the DMX512 inputs and the electronics. Systems having optical isolation on a prewired factory plug-in device shall not be acceptable.

9. Systems must support the above listed industry standard ACN protocols for Ethernet setup, control, and feedback integrated directly between the power system and control system.

D. Power Control Features

1. Power Control shall have a dimmer update rate better than 16ms (60HZ) or 20 ms (50 Hz) average. Dimmer outputs shall exhibit no oscillating or hunting for levels. Dimmers with the same choke type set to the same level shall output within ±1V of each other, regardless of phase or input voltage. Power control shall maintain proper dimming performance for all line feed frequencies from 47-53Hz and 57-63Hz without flicker or misfire. Shifts in frequencies up to 3 Hz shall not result in flicker or loss of dimming timing. Systems must perform to these frequency tolerances and shifts. Dimmer output levels shall be regulated for incoming line voltages. The regulation shall adjust for both RMS voltage changes and deformations in the incoming AC waveform. The power control shall monitor and adjust each dimmer's output to maintain a constant power to the load. Regulation shall maintain the desired output voltage ±1V for the entire operating range (91-139V and 181-259 VACS) with the exception that the maximum output will be no greater than the line voltage minus dimmer insulation loss. The regulation shall compensate for dips and anomalies in the AC waveform on a dimmer by dimmer basis. There shall be no interaction between dimmers in the system or any other equipment. The output shall be nominally regulated to 115V/230V appropriate for the market, but shall be field adjustable on a dimmer by dimmer basis to allow for varying cable length. Systems must maintain performance to the above stated voltage regulation. Power control shall support a rack filled with different types and sizes of dimmer modules. The properties of each dimmer shall be configurable, including

dimmer name, output curve, dimmer firing mode, and scale voltage values.

a) The output curve selections shall include IES Modified Square, Square, Linear, Modified Linear and a Sensor v2.0 output curve. The power control shall also have the capability of storing up to three custom curves as well as an adjustable preheat level, assignable on a per-dimmer basis.

b) The dimmer firing modes shall include: Normal (Dimmed), Dimmer Doubled, Switched (unregulated on/off with adjustable on-at level), Fluorescent with adjustable threshold, and Off.

c) Dimmers set as Dimmer Doubled shall allow a single dimmer to set two different levels on one dimmer circuit by splitting the AC power into positive and negative half cycles with no resultant DC line current.

d) Power Control must support all above listed adjustments to dimmers on a per circuit basis.

2. Controller shall support two (2) methods of automatic configuration during controller replacement in a rack.

a) Use backplane configuration- The backplane shall retain full setup and preset data in. In this recovery mode, when a new power control is inserted, the controller shall automatically come on-line fully functional without any manual intervention.

b) Use controller configuration- Override backplane configuration such that replacement modules automatically use the configuration resident in nonvolatile memory of the power control.

3. Controller shall be capable of changing rack setup for multiple shows for an entire system with a single update command from a remote PC. Show setup shall be saved in XML format and capable of being saved/uploaded from both USB and remote PC.

4. In the event of data loss each rack shall maintain the last level for a user programmable time of zero to five minutes or indefinitely, or may be programmed to fade out or to play a specific preset. Systems must offer this feature.

5. The power control shall contain diagnostic routines to allow the user to test and troubleshoot the system. The power control shall also contain a Test/Bypass switch to turn all dimmers on to full for testing. This switch shall bypass all electronics and shall force the fan on. Systems must include local control, “all on” control bypass, and diagnostic routines.

6. The power control shall be able to record up to 64 presets in a rack. Presets

shall be user programmable by recording a snapshot of current dimmer levels (as set by the all control sources), by entering dimmer levels on the power control directly, or a combination of both methods. The system shall have the ability to program and activate group wide presets from the power control, remote station, console, networked computer, or handheld device. Presets shall be activated in the default fade time of 2 seconds, but shall be have a user-programmable fade time between 0 and 60 minutes.

7. A system wide panic (emergency UL924) activation circuit shall be provided. Any dimmer in any rack may be assigned to the panic circuit. The panic shall be set to a maintained closure. Upon activation, the system shall:

    a) Force all circuits selected to be included in panic to a master level between 80-100%

    b) Optionally force all non-panic dimmers to zero

    c) Provide configurable fade time to and from “emergency” state

    d) Provide configurable delay to and from “emergency” state

8. DMX A and B as well as the Ethernet DMX (EDMX) data may be patched using a rack start address - assigned sequentially from a starting control channel or patched individually on a per-dimmer basis. Priority may be set per universe for the DMX inputs, and set per universe by the control source for Ethernet input. Each dimmer may have up to six network control inputs with either a highest takes precedence or priority patch. Each dimmer may also then be assigned to one of 16 spaces for additional specific preset control. Each preset shall have a separate priority for maximum flexibility of prioritization. Systems that must support prioritization of multiple Ethernet sources beyond HTP shall not be deemed acceptable. Systems must support the above listed flexibility in control source prioritization shall not be deemed acceptable.

9. Power control shall provide the ability to set a single circuit, all circuits or a range of circuits to a level at the control interface in the rack. Systems that cannot locally control dimmers through local control override shall not be acceptable.

10. The power control shall be capable of monitoring and displaying incoming line voltage for all three phases on the LCD. With installed current sensors, the same display shall show amperage on each phase.

11. The power control shall support security protected access. The user shall to able to program passwords that restrict access, preventing unauthorized use of higher-level functions by unauthorized personnel. Systems that do not provide security protected access to features that can render the system unusable shall not be acceptable.

E. Standard Feedback:

1. System and Rack messages shall include, but not be limited to, the following:

a) DMX port A or B has an error or has failed

b) Network has an error or has failed

c) Phase A, B or C is below 90 volts

d) Phase A, B or C is above 140 volts

e) Phase A, B or C did not start because it was below 90V or above 140V at power up

f) Phase A, B or C voltage headroom warning

g) Frequency is not 50 or 60 Hz

h) Rack shutting down due to air flow loss

i) Ambient temperature is below 0°C/32°F

j) Ambient temperature is above 40°C/104°F

k) Rack shutting down - ambient temperature exceeds 46°C/115°F

(1) Configuration memory error

(2) About display shall allow monitoring of system, rack or dimmer status.

(a) About System shall provide information about Panic circuits, Preset looks, and System name.

(b) About Network shall provide IP address, gateway and net mask.

(c) About Rack shall provide information about rack name, ambient temperature, air filters and rack type.

(d) About Rack Power shall provide information about power type, rack voltages, current per phase (only with current transformers), under voltage warnings.

(e) About Rack Data shall provide status for DMXA, DMXB, EDMX and Network activity.

(f) About Dimmer shall provide information about dimmer type, location, output level, control source, scale voltage, mode and curve.

F. Advanced Feedback:

1. Sensor's Advanced Features (AF) option shall add an additional sensor in the individual dimmer modules. This option shall allow monitoring of current and output voltage on a dimmer by dimmer basis and provide information on lamp burnouts, dimmer status, and input voltages.

2. Power control shall allow the user to record the loads of all AF dimmers in the system. The power control shall, during operation, test each AF dimmer, determine its load, and compare it to the recorded load. Any change from recorded loads of configured tolerance shall display an error on the power control and any monitoring device on the network. If a dimmer is driven on with no load, an optional message shall be available to notify the console operator and electrician that there is no load.

3. Dimmer Specific messages shall include, but not be limited to, the following:

a) Load has dropped below recorded value

b) Load has raised above recorded value

c) DC detected on dimmer output

d) One SCR has failed on/off

e) Dimmer has failed off or circuit breaker has tripped

f) Dimmer has been removed

g) Dimmer load has failed

h) Dimmer has shut down due to over temperature

i) About Dimmer display shall provide additional information regarding the dimmer's recorded load and current or actual load

G. Network Interface:

1. The Ethernet network shall provide an integral link to connect all racks in the system for rack-to-console and rack-to-network device communication.

2. The network interface to the power controller shall provide a number of user-programmable control schemes between control sources, including architectural control.

3. Hardware settings for rack type, available module types, availability of AF features, and operating voltage shall be configurable at the factory or in the field, and shall not require secondary setup after system commissioning even in the event to power controller replacement.

4. User programmable parameters shall support onsite setup, via the local interface in the rack. These parameters shall include, but not be limited to, defining module type, scale voltage for each dimmer, firing mode, curve, dimmer numbering and DMX512 or network port assignments. Systems requiring factory programming shall not be acceptable.

H. Provide one (1) CEM3 control module.

IV. CONTROL PROCESSOR MODULES

A. The Architectural Control Processor shall be the Unison SmartLink S-ACP Series Control Processor as manufactured by Electronic Theatre Controls, Inc., or equal.

B. Mechanical:

1. The Architectural Control Processor (ACP) assembly shall be designed for use in DRd Series Rack Enclosures.

2. The processor shall utilize microprocessor based, solid state technology to provide multi-scene lighting and building control.

3. ACP module electronics shall be contained in a plug-in assembly.

a) The module shall be housed in a formed steel body and contain no discrete wire connections.

(1) No tools shall be required for module removal or insertion.

4. The ACP shall be convection cooled.

5. User Interface

a) The ACP shall utilize a backlit liquid crystal display capable of graphics and eight lines of text.

(1) The backlight shall have a user selectable time out, including no time out.

b) The ACP shall provide a numeric keypad for data entry and navigation.

c) The ACP shall provide a touch-sensitive control wheel for navigation.

d) The ACP shall provide shortcut buttons to assist in navigation, selection, and data entry.

6. The ACP shall provide a Secure Digital (SD) Removable Media slot on the front panel for saving and loading of configuration data.

a) The SD slot shall be secured behind the locking door.

C. Electrical:

1. The ACP shall require no discrete wiring connections; all wiring shall be terminated into the dimming enclosure.

2. The ACP shall require low-voltage power supplied by the dimming enclosure.

3. The ACP shall be hot-swap capable.

4. The ACP shall support Echelon LinkPower communications with remote devices, including button stations and timeclock stations.

a) The LinkPower network shall utilize polarity-independent, low- voltage Class II twisted pair wiring, type Belden 8471 (unshielded) or Belden 8719 (shielded) or equivalent. One # 14 AWG drain wire will be required for system not using grounded metal conduit.

b) The LinkPower network shall be topology free. Network wiring may be bus, loop, home run, star or any combination of these.

c) Link power wiring shall permit a total wire run of 1640 ft. (500m).

d) Link power wiring between stations shall not exceed 1313 ft. (400m).

5. The ACP shall support one ESTA DMX512A port, for DMX input.

a) DMX input support of 8 or 16 bit DMX.

b) Shall support DMX through of incoming DMX control signal.

D. Functional:

1. Capacity

a) Shall support 48 channels of control.

b) The ACP shall support 1 physical DMX port for DMX input.

c) The ACP shall support 64 presets using any combination of 48 channels.

2. System

    a) System shall support local firmware upload from removable media (SD media)

3. Configuration Data

    a) Configuration data shall be locally stored in non-volatile memory

    b) Configuration Data may be loaded to and from removable media. access provided on front panel (SD media).

4. Local User Interface

    a) Shall provide access to Processor status

    b) Shall provide access to Dimming enclosure setup and status

    c) Shall provide control functionality for Control Channels, Presets, and Sequence within the current configuration.

    d) Shall allow for display of local DMX information

    e) Shall allow to perform firmware upgrades for connected Dimming enclosures

    f) Shall allow for transfer of configuration to and from Dimming enclosures using removable media (SD media)

5. Access Controls

    a) There shall be 2 user accounts - Administrator, and User with separate password protection

    b) Account and password settings shall be local to each Processor

6. Stations

    a) Stations shall be connected to a SmartLink Processor via LinkPower network

7. Operation

    a) The ACP shall support control channel patch functions individually or for each of its 48 channels to any of 512 channels

    b) Configurable control signal-loss behavior including hold last look, wait

and change to present or wait and change to off

c) Support of 64 channel presents with DMX snapshot

d) User programmable up, down and hold times as well as configurable sequence

(1) Times shall be configurable from 0 to 60min, 59sec

(2) Sequence shall include at least 1, up to 64 presets and use the timing of each independent preset.

e) The ACP shall be capable of standalone operation and support host preset activation to and from other SmartLink products

f) Shall support the following dimmer modes; normal, dimmer doubled, switched, 2/3 wire fluorescent, 4 wire fluorescents, DALI, Constant On, Off and Reverse Phase

g) The ACP shall support multiple dimmer outputs including IES modified square law, linear, switched, fluorescent with adjustable cut-off, and adjustable pre-heat tandard rack feedback indications shall include

(1) Dimmer over-temperature

(2) Rack power status including under and over voltage

(3) DMX input status

h) Upon power cycle, the ACP shall return to its previous output state

i) The ACP shall boot in less than 5 seconds

j) DMX output refresh rate shall be configurable

k) There shall be support for 16-bit DMX Attributes

l) On Preset Record, the values of Attributes within the Preset shall be updated to reflect the current output

m) Each Preset shall have a status that can be Activated or Deactivated

E. Provide one (1) SmartLink Architectural Processor.

V. DIMMER MODULES

A. The dimmer modules shall be the Sensor Advanced Features modules as manufactured by Electronic Theatre Controls, Inc., or equal. Sensor Modules shall be designed for

complete flexibility of choice for dimmed, non-dim, or hot power on each 20A branch circuit. A single module shall provide one of the following:

1. Two dimmed outputs with choice of 500 or 350us rise times, controlled by DMX.

2. Two air gap relay switched outputs controlled by DMX.

3. Two manual bypass constant power circuits, controlled manually.

    a) The module may be configured to operate as two dimmers, two relays, or any combination of relay and dimmer from the CEM3 Power Control Module or from an ETC control console connected to a CEM3 system. Any single circuit may be set to bypass the dimmer using a switch on the front of the module.

4. The power control system shall report circuit specific errors via the rack control electronics and/or via a lighting control console.

5. Modules shall provide the following status reporting functions:

    a) Load dropped below recorded value

    b) Load increased over recorded value

    c) DC on dimmer output

    d) SCR failed on/off

    e) Circuit breaker tripped

    f) Dimmer error

    g) Module removed

    h) Load absent

B. Electrical:

1. Each dimmer module shall contain two single-pole circuit breakers, a solid-state switching or dimming module, associated toroidal filters, power and control connectors, a 120VAC remotely controllable mechanically latching air gap relay, a low voltage dc manual bypass override switch, and one fuse per branch circuit for sufficient short circuit rating.

2. Modules shall not have any protruding pins subject to physical damage when the module is not installed.

3. Modules shall be keyed so that dimmer modules of different capacity shall not

be interchangeable.

4. Each dimmer shall be protected by a fully magnetic single pole, 20 amp, or as shown on the Drawings, one hundred percent (100%) rated circuit breaker listed at 10,000 amps or greater interruptible current mounted on the face plate of the dimmer. The breaker shall be used as a dimmer disconnect and shall be rated for 100% switching duty. Circuit breakers shall be rated for tungsten loads having an inrush rating of no less than 20 times normal current. Under overload conditions, the circuit breaker shall disconnect power to the dimmer module before damage can be done to the power devices. The trip current shall not be affected by ambient temperature within the operational specifications of the system. Dimmers must operate continuously at 100% load.

5. Modules that use Triac dimming shall not be acceptable. Modules which utilize an SCR or Triac solid state switch as a dimmer bypass may void warranty of products they are powering and shall not be an acceptable means of bypass.

C. SCR Assembly:

1. Each dimmer shall be rated 2.4kW.

2. Each dimmer module shall use a solid-state module (SSM) consisting of two silicon-controlled rectifiers (SCRs) in an inverse parallel configuration, and all required gating circuitry on the high voltage side of an integral, opto-coupled control voltage isolator. Rectifiers, copper leads and a ceramic substrate shall be reflow soldered to an integral heat sink for maximum heat dissipation. The SSM shall also contain a control LED, a thermistor for temperature sensing, and silver-plated control and load contacts. The SSM shall include an integral output LED, output voltage sensors and current sensors for feedback to the control module. The SSM shall provide a parallel output connection which completely bypasses all SCR dimming including toroid filters and shall intercept the output prior to connection of the load sensing circuit such that the advanced features are still active during bypass. The entire SSM shall be sealed in a plastic housing requiring only a screwdriver to replace. Dimmers must employ triac power devices, pulse transformers, or other isolating devices providing at least 2,500V RMS isolation. Dimmer modules requiring disassembly, heat sink grease or additional tools for repair shall not be acceptable.

3. All electronic components (current/voltage sensors and indicators) shall be contained in a single, field-replaceable housing. Modules requiring discrete wiring of electronic components shall not be acceptable.

4. SCR power switching devices shall have the following minimum ratings:

Module Size:	20A
Single cycle: Peak surge current	625A

Half cycle: 12T	1,620
Transient over voltage	600V
Die size (in)	.257

D. Filtering:

1. Dimmer modules shall include toroidal filters to reduce the rate of current rise time resulting from switching the SCRs. The filter shall limit objectionable harmonics, reduce lamp filament sing and limit radio frequency interference on line and load conductors. Modules shall offer 350 or 500 uS, filter rise times. Rise time shall be measured at the worst case slew rate (about 50 percent) from 10 to 90 percent of the output wave form with the dimmer operating at full load.

E. All dimmers shall maintain their published rise time and/or fall time regardless of duty cycle or rack temperatures. Dimmers that de-rate due to increased dimmer temperature caused by full load operation or high phase angles shall not be acceptable.

F. Power efficiency for standard dimmers shall be at least 97 percent at full load with a no-load loss of 3V RMS. The dimmer shall accept hot patching of a cold incandescent load up to the full rated capacity of the dimmer.

G. Dimmer modules shall be fully plug-in and factory wired. Dimmer modules shall consist of a heavy duty, die-cast aluminum chassis with integral face panel. No tools shall be required for module removal and insertion. All parts shall be properly treated, primed and finished in fine-texture, scratch resistant, gray epoxy powder coat. With the exception of the circuit breaker, the module shall contain no moving parts. Each module shall be labeled with the manufacturer's name, catalog number and rating. Modules constructed of molded plastic for structural support are not equivalent and are not acceptable. Modules shall be UL Recognized.

H. Provide twelve (12) D20AFTR Advanced Features Thru Power Dimmer Modules (7083A1022).

I. If manufacturer is unable to provide a Thru Power Module, manufacturer shall provide an additional 20% of spare relay modules in addition to the dimmer modules.

VI. PRESET STATIONS

A. The Button station shall be the SmartLink Button Station as manufactured by Electronic Theatre Controls, Inc., or equal. It shall be a remote station on an Echelon LinkPower network that can play presets stored in a host product such as a SmartPack dimmer pack, SmartSwitch Relay panel or in the Control Electronics Module (CEM+) of a Sensor+ dimmer rack. The station shall consist of a dual function (program/play) push-button with an integral LED for each corresponding look.

1. Standard stations shall control 5 or 10 backup looks.

2. The system shall support up to four stations without an additional power supply.

B. Electrical:

1. Button station wiring shall be an Echelon® Link power network. Link power shall utilize low-voltage Class II unshielded twisted pair, type Belden 8471 or equivalent, and one #14 ESD drain wire (when not installed in grounded metal conduit).

2. The station shall operate on ± 21 VDC provided by the CEM+ via the Link power network (for more than 4 stations, an additional power supply shall be required). The number of stations shall be limited by the available power.

3. Station wiring must be topology free. It may be point-to-point, bus, loop, home run or any combination of these.

4. Network insulation displacement connectors shall be provided with all stations

C. Station Addressing

1. Preset addressing for stations shall be via a 7- position dipswitch, and will be set by installers or factory personnel. Stations shall address only consecutive presets. Multiple stations of the same type and address are permissible. Multiple stations with different button quantities may have “overlapping” preset addresses.

2. Stations shall not address presets in different rooms.

D. Play Presets

1. Pressing a button shall play the corresponding preset. The station will send the command to play the look to all host products. If the look is a recorded look, the button's LED will stay lit. If the look is unrecorded, the LED will go off.

2. The station shall monitor (at 30-second intervals) the status of presets. If any looks are active in the range of the station's numbered push-buttons, the station shall light the corresponding LED regardless of which device (console, host product, network PC or Button station) activated the look.

3. If the button with the active look (LED lit) is pressed, the station shall send the command to return to normal operation, deactivate the preset and turn off the LED.

4. Only one preset may be active at a time. Pressing a second button shall play the corresponding preset and fade out any preset previously active.

E. Physical

1. Control station electronics shall mount directly behind the faceplate. A terminal block shall be supplied for contractor terminations. The entire assembly shall mount into a single gang back box. Back boxes for the flush mounted stations shall be industry standard back boxes. The manufacturer shall supply back boxes for surface mounted stations.

2. Station faceplates shall be constructed of ABS plastic and shall use no visible means of attachment. All Button stations shall be available with white, signal white, ivory, gray or black faceplates and buttons.

F. Provide SmartLink preset button stations SH 10005 (five button) and SH 10010 (ten button) station in the quantities shown on the Drawings.

VII. DATA PLUG-IN STATIONS

A. Data Plug-in Stations shall consist of the appropriate connectors required for the functional intent of the system. These stations shall be available with DMX input or output, Remote Focus Unit, Network, or architectural control connectors as shown on the Drawings or as required.

B. Connector Options:

1. The following standard components shall be available for Plug-in Stations:

a) 5-Pin male XLR connectors for DMX input

b) 5-Pin female XLR connectors for DMX output

c) RJ45 connectors for Network connections - Twisted Pair

C. Physical:

1. Station faceplates shall be .80” aluminum, finished in fine texture, scratch-resistant black powder coat. Silk-screened graphics shall be white.

2. The station panel shall mount into an industry standard back box, depending on size and quantity of connectors. A terminal block shall be supplied for contractor terminations.

D. Provide Data Plug-In Stations of the types and quantities shown on the Drawings.

VIII. LIGHTING CONSOLE AND ACCESSORIES

A. General:

1. The lighting control console shall be a microprocessor-based system specifically designed to provide complete control of stage, studio, and entertainment lighting systems. The console shall be the Element as manufactured by Electronic Theatre Controls, Inc., or equal.

2. The control system shall be Net3 and Net2 native, with both protocols output simultaneously over the network. The system shall also be able to control third party ACN devices directly. The system shall provide control of 1024 outputs on 250 or 500 channels.

3. A maximum of 10,000 cues, 1000 groups, 1000 Intensity Palettes, 1000 Color Palettes, 1000 Focus Palettes, 1000 Beam Palettes, 1000 effects, 1000 macros and 100 curves may be contained in non-volatile electronic memory and stored to an onboard hard disk or to any USB storage device.

4. The console may be placed in Tracking or Cue Only mode by the user as a system default and overridden on individual record actions as required.

5. A Master Playback fader pair and dedicated Grand Master/Blackout shall be provided.

6. The console shall provide 40 or 60 pageable faders and bump keys that may be operated in either LTP channel or HTP/LTP submaster mode. The console shall support a total of 300 submasters.

7. A high-resolution level wheel shall be provided to control intensity for selected channels and scrolling within selected displays. On demand moving light controls shall be provided for control of other non-intensity parameters. Non-intensity parameters shall be controllable via the on demand or keypad controls.

   On demand moving light controls shall provide mouse-based tools for non-intensity parameters. The tools shall display the current value for each parameter and shall provide controls for adjusting each parameter.

8. Control and programming features for automated fixtures shall also include: a standard library of fixture profiles, the ability to copy and edit existing profiles and create new profiles, patch displays including channel and output addressing, 16-bit fade resolution, color characterization allowing color mixing and storing in Hue and Saturation or native device values.

9. System information, including playback status, live output and blind values for all record targets shall be displayed on a maximum of two external high resolution DVI monitors, or one SVGA monitor, which may also be touch-screen(s). Only one display shall be required for operation.

10. The system shall direct user input through on-screen dynamic prompts and integral LEDs on console keys indicating current operating mode. A context

sensitive on-line Help feature shall explain and provide an example of the operation of each feature of the system.

11. An optional, fully-functioning, detachable alphanumeric keyboard shall be supported. The keyboard shall allow labeling of channels, cues, presets, groups, palettes, effects, macros, curves and the show. An integral electronic keyboard shall be provided.

12. A row of softkeys shall be provided, which change function based on the selection and context of the console. These softkeys shall be labeled on the connected external display.

13. Console software upgrades shall be made by the user via a USB port; changing internal components shall not be required.

14. The console operating software shall be loaded into program execution memory from the internal hard drive when the console is powered. In the event of an uncontrolled shutdown, the console shall return to its last output state when power is restored.

15. Show data may be created and modified on a personal computer, using either Windows XP or Windows 7 operating systems, using a free offline editing application. The offline editor may also run natively on Macintosh platforms using OS X.

16. A PC, using Windows XP, Windows 7, or a Macintosh computer running OS X, running a client software application shall be able to connect to a control system via the network and view current show data in a mirrored display environment.

17. The system shall allow remote control from a purpose-built wireless remote focus unit (Radio Focus Remote). Systems without these remote-control devices shall not be acceptable.

18. The system shall support a Telephone remote control that allows basic functions to be controlled from a standard wireless phone producing touch-tone signals. This allows the use of a standard telephone for a low cost remote control. Systems that do not allow this function shall not be acceptable.

19. Network management tools shall be provided from the desk itself.

20. The system shall support up to 32 individual Time Code Event lists.

B. Controls and Playback:

1. Manual Control and Programming Section

a) The console keyboard shall be grouped by function. Major groupings shall be record target functions, numeric keys, level assignment

functions, display navigation functions and controls. Non-intensity parameters may be set numerically or via the on demand moving light controls. This control shall be fully interactive. In either case the current parameter value shall be displayed on the console monitor. Only those parameters available for control in the active lighting system shall be displayed for control. Lamp controls provide direct access to luminaire functions such as striking and dousing arc lamps and calibrating entire fixtures or individual mechanisms of fixtures, as provided by the luminaire manufacturer. User access to these features is normalized across all manufacturers for ease of use. Use of a “control channel” for accessing these functions shall not be required and systems requiring use of a control channel shall not be acceptable. Fixtures with CMY or RBG color mixing may be set with direct CMY or RBG controls, as well as the Hue and Saturation controls and/or color picker. Color may also be set directly to a gel match, normalized to 3200K.

2. Playback Section:

    a) The master fader shall consist of a 60mm Master Fader pair with associated Load, Go and Stop/Back buttons.

    b) It shall be possible to instantaneously halt an active cue, go back to the previous cue, manually override the intensity fade or manually override the entire fade.

3. Integral Channel/Submaster Faders:

    a) Submaster and fader support shall be provided via 40 or 60 integral 45mm faders with bump leys. These faders shall be pageable and shall operate in LTP channel and LTP/HTP submaster modes.

    b) LTP channel mode shall allow the user access to intensity of the first 120 channels and shall operate with LTP logic. Faders that are not currently set to the same level as the corresponding channel shall have to be matched to that level before affecting said channel.

    c) Up to 240 proportional, fully overlapping additive or inhibitive submasters may be defined. Submasters shall have colored LEDs to indicate submaster status. Each submaster may have fade up, dwell and down fade times. Each has a bump and assert/channel select button. Submasters may be set to independent, exclusive and proportional/intensity master control.

    d) The submaster blind buffer shall be linked directly to live playback allowing live editing of live submaster content via the command line.

    e) It shall be possible to set submaster values directly from the command line.

4. Grand Master:

    a) A dedicated 60mm grand master and blackout button are provided.

    b) The grand master shall proportionally fade intensity values to zero. Blackout shall send all intensity outputs to zero. Non- intensity outputs shall not be affected. No additional configuration shall be required to withhold non-intensity values from Grand Master and Blackout control.

C. Display Controls:

1. Format shall change the view of selected displays.

2. Channel views may be displayed either in a expanded table view combining conventional channel symbols with table views for multi- parameter devices, or in a channel summary view.

3. Flexi channel shall change which channels are viewed in selected displays, based on a variety of different criteria, including all channels, patched channels, active/move channels, manual channels, selected channels and user-specified channel lists.

4. Expand shall extend the selected view sequentially across connected displays.

5. Data shall display absolute values of referenced data.

D. Operating Modes:

1. Live Mode:

    a) Channel lists may be constructed using the +, - and Thru keys.

    b) Levels may be set with the keypad, level wheel and on demand moving light controls. “Selected” channels shall be those last addressed and under keypad control.

    c) Sneak shall be used to restore specified channels to background states, default values, or to send them to specified values, in user specified or default times.

    d) Selected channels may be set at a level or held to current values while all other channels are set to zero using Rem Dim. Toggling Rem Dim shall restore all unselected channels to original levels. The Rem Dim level shall be user definable.

    e) Channels may be recorded into groups for fast recall of commonly used channels. 1000 groups shall be available. Groups shall store selection

order. The Offset function supports rapid creation of ordered groups, including reverse and random order.

f) Parameter settings may be stored to Focus and Color Palettes. All referenced data may be stored to whole numbers or to up to 99 decimal places between each whole number. It shall be possible to store 1000 of each palette type.

g) Any collection of channel data, as determined by the use of “Record” or selective store commands may be stored to palettes (as appropriate to the type).

h) The following conditions may be placed on a channel or channel parameter to be included with a cue record action.

(1) Block flag

(2) Note

i) Cues may be recorded in any order. Up to 99 decimal cues may be inserted between any two whole number cues. Each cue may contain a maximum of twenty parts. Parameters may be automatically assigned to specific parts or assigned when the part is created.

j) It shall be possible to record cues and cue parts with the following information:

(1) Any collection of channel data, as determined by the use of “Record” or selective store commands.

(2) Cue Level timing and delays for Intensity Up and Intensity Down, Parameter moves shall follow the Intensity Up time.

(3) Follow or hang time

(4) Link instruction

(5) Loop value

(6) Block and/or preheat

(7) Curve

(8) Label and note

(9) Execute list to trigger other activity

k) Non-intensity channel parameters may be marked (preset using

Automark. Automark presets any parameter transitions in the cue just prior to intensity becoming active. Automark may be disabled on a cue or cue part basis, enabling a “live” move.

l) Any channel parameter may be stored with an effect instruction. These effects may contain relative offsets from current value, or absolute instructions. Effects may be progressive action or on/off states. Entry and exit behaviors shall modify the channel parameters activity when beginning and ending the effect.

m) Update may be used to selectively add modified parameter data quickly to that parameter’s current source. It shall be possible to update inactive record targets. It shall also be possible to update back to the current source of the move instruction without specifying that cue via Trace.

n) Recall From quickly pulls specified data from record targets into the current view.

o) Copy To quickly copies selected data to specified record targets.

p) Address and channel check functions shall be provided.

q) Channel parameters may be “parked” at levels. Output addresses may also be parted directly. Parked levels shall not be added to any live record operations, nor may they be changed until the parked element is “unparked”. Address park shall also be provided.

r) About shall provide detailed status of selected channels or specified record targets, including utilization information. About shall also access lamp control functions to calibrate devices, strike and douse arc sources. Use of a luminaire control channel for these functions shall not be acceptable.

s) Live data may be displayed in an expanded table view containing conventional symbols and table views for multi-parameter devices or in a summary view.

t) Undo shall be used to sequentially step back through manual operations, record, update and delete actions. Redo functions shall be provided. Multiple undo commands may be executed at once.

u) Home shall set selected channels non-intensity parameters to their default values.

v) Move shall allow all show data to be moved from one record target to another.

2. Blind:

    a) The Blind display allows viewing and modification of all record targets without affecting stage levels.

    b) Record target data may be displayed in an expanded table view containing conventional symbols and table views for multi- parameter devices, in a summary view or a spreadsheet view, which allows quick data comparisons, move and replace with functions.

    c) Changes made in blind displays shall be stored automatically.

    d) Blind editing shall be possible for all record targets.

    e) It shall be possible to show or hide parameter data in spreadsheet views for simplicity in viewing/editing.

3. Patch Display:

    a) Patch shall be used to display and modify the system control channels with their associated library data.

    b) Each channel may be provided with a proportional patch level, preheat, curve, label, swap and invert functions.

    c) Offset functions in patch shall allow selection of channel ranges and shall allow the user to establish a “custom” footprint for any device output.

    d) Custom color wheels, color scrolls and gobo wheels shall be defined in patch. These devices shall be created with a simple table and graphical user interface supported by images of major manufacturers.

    e) Copy to and Move functions shall be supported in patch.

4. Setup/Browser:

    a) Setup shall access system, show and desk configurations.

    b) The browser shall access show data storage, import, export, print to .pdf and clear functions, as well as show data utilities.

E. Interface Options:

1. The console shall support a variety of local interfaces.

    a) AC input.

b) USB (a minimum of five ports shall be provided for connecting devices such as a Alphanumeric keyboard, mouse, touch screens, USB Flash drive, etc.) The desk shall provide at least four ports on the rear of the console and one on the control surface itself.

c) Ethernet (one port) 802.3af compliant

d) Two (2) DVI video output connectors, supporting a maximum of two DVI monitors at 1280x1024 resolution minimum.

e) One (1) VGA output connector.

F. Accessories Required:

1. iRFR an iRFR Preview (applications for iPhone, IPod Touch and iPad)

2. aRFR (application for Android devices)

3. Element Client Software Kit

4. Two (2) 19” ELO LCD Touchscreen monitors with DVI

G. Physical:

1. All operator controls and console electronics for a standard system shall be housed in a single desktop console, not to exceed 32.9” wide, 17.9” deep, 5.1” high, weighing 30 pounds.

2. Console power shall be 95 – 240V AC at 50 or 60Hz, supplied via a detachable power cord.

H. Provide:

1. One (1) Element 60 with 250 control channels.

IX. DMX/RDM REPEATER (OPTO-SPLITTER)

A. The DMX/RDM Installation Repeater shall permit star-wiring of DMX512 signals and shall isolate DMX transmitters and DMX receivers from common mode voltages, ground loop currents and other electrical faults.

1. The DMX/RDM Installation Repeater shall have bi-directional ports to allow Remote Device Management (RDM) data packets to be sent and received between control systems and responding devices.

2. Each DMX/RDM Installation Repeater shall have one input port and eight output ports. No in-line processing of the input signal is permitted to ensure the highest reliability.

3. DMX signal splitting shall be provided using 4-output DIN-rail mounted modules for easy expansion and/or servicing.

4. The system shall be capable of repeating simplex protocols other than DMX512, provided they meet the electrical requirements of EIA-RS422 or RS485.

B. Physical:

1. Enclosures shall be surface-mount NEMA 1 enclosure types, and shall be constructed from 18 gauge steel, finished in satin black powder epoxy, with a non-louvered, surface cover.

2. Dimensions shall be 10.25” x 23.25” x 4.5” (260mm x 510mm x 120mm) for the eight output units.

3. Enclosures shall be provided with ½” and ¾”conduit knockouts, appropriate internal voltage barriers, and shall be clearly labeled as “Pathway eDIN System”.

C. Electrical:

1. The power supply shall be a field-replaceable, wide-range input (115/240VAC, 50/60 Hz), UL-listed switching power supply. There shall be no power switch to reduce the chance of accidental shut-off.

2. There shall be 2500-volt electrical isolation between all input and output sections, and between adjacent output sections.

3. The input and each output shall be capable of withstanding the continuous application of up to 250V without damage to internal components. Input and output protection shall be of the self-resetting type, rated for 250V. Replaceable fuses are not acceptable.

D. Field Connections:

1. All internal field wiring connections shall be clearly labeled according to their function.

2. Connections for all data input, output and pass-thru ports, and DC power shall be two-part, Phoenix-type screw terminal strips, capable of accepting #26 to #14 gauge solid or stranded wire.

3. An active, isolated data pass-thru connection port shall be provided to allow daisy-chaining of additional modules or Installation Repeaters.

4. The power supply connections shall be capable of accepting up to #12 gauge

solid or stranded wire. A suitable terminal shall be provided for ground wire connection.

E. Features:

1. Each repeater module shall incorporate LED indicators for DC power input, isolated DC power, DMX input and processor status.

2. Each module shall have two LEDs per output port to indicate active DMX output and RDM activity for that port.

3. Each module shall be individually discoverable via RDM. No remote configuration options shall be available to the user.

4. Each DMX/RDM port shall incorporate an active data line terminator.

F. Compliance:

1. The DMX/RDM Installation Repeater shall be compliant with ANSI E1.11 DMX512-A (2004), USITT DMX512 (1990) and ANSI E1.20 Remote Device Management (2006).

2. The DMX/RDM Installation Repeater shall be ETL-listed.

3. The DMX/RDM Installation Repeater shall be compliant with the RoHS 2002/95/EC directive.

G. Acceptable Product:

1. Supply Pathway DMX/RDM Installation Repeaters only.

2. This specification applies to Pathway Model #4814 only.

H. Provide one (1) Pathway 8-way eDIN DMX/RDM Installation Repeater, Model No. 4814 or approved equal.

X. ELECTRICAL DISTRIBUTION EQUIPMENT

A. All distribution equipment shall be furnished by the manufacturer of the dimming equipment. Hanging and supporting hardware shall be furnished and installed under SECTION 11064 "THEATRE AND STAGE EQUIPMENT - RIGGING SYSTEMS".

B. Connector Strips shall be furnished and installed where shown on the Drawings. Use only when providing connector strips, usually only used in front of stage when not in a gym. Can be used on stage if sufficient ceiling height. Consult with PGCPS.

1. Each connector strip shall be complete with three-pole, 20A grounded stage pin connector type female receptacles.

2. Internal wiring shall be sized to circuit ampacity and shall be rated at 125°C.

3. Terminations shall be at one end using feed-through terminals individually labeled with corresponding circuit numbers.

    a) 20 amp circuits shall use screwless tension clamp terminals listed for 20 – 8 gauge wire.

    b) Terminals that place a screw directly on the wire are not acceptable.

4. Connector strips shall be supplied with appropriate brackets and hardware for mounting as shown on the Drawings.

    a) Connector strips shall have junction brackets on 5’ centers.

    b) Brackets shall be 1 ½” x .188” ASTM A 36 steel.

    c) Hardware shall be ASTM A307 grade 5.

5. A low voltage distribution system shall be available to incorporate DMX, Ethernet or other protocols as specified in the connector strip. Connector strips shall utilize a voltage barrier to accommodate these systems. Low Voltage signals shall enter the connector strip via a strain relief or connector mounted in a separate low voltage terminal box at the specified end of the connector strip. Up to four low voltage cables shall be supported for each connector strip.

    a) Connector strips with multiple DMX outputs from the same source shall use DMX pass through assemblies consisting of a 6” panel with the one DMX output connector, one DMX input (Pass Through) connector, one DMX pass through (Bypass) switch, and a label detailing the use of the pass through assembly.

    b) The bypass switch shall be used when no DMX devices are present at that location. When activated, the DMX pass through switch shall pass DMX directly through to the next DMX panel on the strip. The pass through switch shall have a mechanical indicator to show the operator that it has or has not been engaged

6. Physical:

    a) Connector strips shall be 6.25” H x 3.3” D and fabricated from 18-gauge galvanized steel and finished in black fine-texture powder coat paint.

    b) Covers shall be fabricated from 16-gauge galvanized steel.

    c) Connector strips shall be available in any length specified in increments

of 6” and shipped fully wired with all splicing hardware.

d) Connector outlets shall be spaced on 18” centers, or as otherwise specified or shown on the Drawings.

e) Outlets shall be mounted on individual 3” panels.

f) No external terminal boxes shall be required for connector strips with 28 or fewer circuits unless otherwise specified.

g) Circuits shall be labeled on the connector strip with 2” high lettering. Circuit labeling shall be located on the front side of the connector strip with white lettering on black background.

7. Connector strips shall support and include optional LED indicators to indicate the presence of power at each local circuit. The LED indicator shall be red in color and mounted in the connector strip directly below the outlet panel.

8. Connector Strips shall be Underwriter Laboratories (UL) LISTED. The connector strips shall be the Electronic Theatre Controls, Inc. 99 series or equal.

C. Gridiron Junction Boxes shall be furnished and installed where shown on the Drawings or required. (Use this only when providing connector strips)

1. Gridiron junction boxes shall be available to accommodate SO or SOW cable wiring into connector strips mounted to non-fixed locations.

2. Junction Boxes shall be fabricated from 16-gauge cold rolled steel with 14 gauge end panels. They shall be finished with fine-textured, scratch- resistant, black powder coat paint. Cover(s) shall be 16-gauge cold rolled steel and hinged to allow mounting in any direction. Cover(s) shall be attached with machine screws and Tinnerman retainer nuts.

a) Boxes for 30 circuits or less shall be 14”H x 14”W x 4”D.

b) Boxes for 31 to 60 circuits shall be 14”H x 28”W x 4”D.

3. Junction boxes shall include mounting brackets and hardware.

4. Wiring terminations shall be made using feed through terminals individually labeled with corresponding circuit numbers.

a) 20 amp circuits shall use screwless tension clamp terminals listed for 20 – 8 gauge wire.

b) Terminals that place a screw directly on the wire are not acceptable.

5. A low voltage distribution system shall be available to incorporate DMX,

Ethernet or other protocols as specified with the gridiron junction box.

a) Low voltage junction boxes shall attach to gridiron junction boxes to simplify wiring to a discrete device.

b) Low voltage signals shall enter the junction box via a strain relief or connector mounted in a separate low voltage terminal box on the top or bottom of the gridiron junction box.

c) Up to four low voltage cables shall be supported for each junction box location.

6. Gridiron junction boxes shall be Underwriter Laboratories (UL) LISTED. The gridiron junction boxes shall be the Electronic Theatre Controls, Inc. GB Series or equal.

D. Plug-in Outlet Boxes shall be furnished and installed where shown on the Drawings.

1. Plug-in outlet boxes shall be complete with three-pole, 20A grounded stage pin connector type female receptacles attached to twenty four (24) inch pigtails.

2. Pigtails shall be three-wire type “SOW” rubber jacketed cable sized for the maximum circuit ampacity.

3. Pigtails with 20 amp stage pin connectors shall be terminated using 12 gauge 4 way indent crimp (with inspection window) type where the wire is inserted and crimped directly in the socket.

4. Terminations for pigtail connectors shall utilize feed-through terminals individually labeled with corresponding circuit numbers. 20 amp circuits shall use screwless tension clamp terminals listed for 20 – 8 gauge wire. Terminals that place a screw directly on the wire are not acceptable.

5. Pigtail outlet boxes shall be supplied with appropriate brackets and hardware for mounting as shown on the Drawings.

a) Standard mounting options shall include pipe or wall mounting.

b) Brackets shall be made from ASTM A 36 steel.

c) Hardware shall be ASTM A307 grade 5.

6. A low voltage distribution system shall be available to incorporate DMX, Ethernet or other protocols as specified in the plug-in outlet box where shown on the Drawings.

a) A voltage barrier shall be used to separate the low voltage wiring for the electrical circuits.

7. Physical:

    a) Plug-in outlet boxes shall be 6.25” H x 3.3” D and fabricated from 18 gauge galvanized steel and finished in black fine-texture powder coat paint.

    b) Covers shall be fabricated from 16-gauge galvanized steel.

    c) Plug-in outlet boxes shall be available in any length specified in increments of 3-inches with a maximum length of up to 3-feet.

    d) Pigtails and outlets shall be spaced on 4” centers, or as otherwise specified.

    e) Pigtail outlets shall be mounted on individual 3” panels.

    f) Circuits shall be labeled with 1.25” lettering. Circuit labeling shall be located on the front side of the plug-in outbox with white lettering on black background.

    g) Pigtail boxes shall support and include optional LED indicators to indicate the presence of power at each local circuit. The LED indicator shall be red in color and mounted in the cover plate directly below the circuit label for pigtail circuits.

8. Plug-in outlet boxes power distribution equipment shall be Underwriter Laboratories (UL) LISTED. Plug-in pigtail outlet boxes shall be the Electronic Theatre Controls, Inc. 9300 Series or equal (for surface or pipe mounting) or 9400 Series or equal (for flush wall mounting).

E. Pipe Batten

1. The pipe batten shall be 1½” schedule 40 grade A, seamless pipe fabricated in the largest possible lengths without splices. Battens of greater length shall be spliced by means of .120 x 1 9/16 dia. DOM tube 18” long with 9” of tube inserted into each half of the splice. The tight fitting splice tube shall be held in place by a pair of 3/8 x 2 ½” grade 5 hex bolts on each side of the joint. The bolts shall pass through the pipe at an angle of 90° to each other. There shall be two bolts on each side of the joint spaced 1” and 8” from the joint. Alternatively, one pair of bolts on one side of the joint may be replaced with either plug welds or tight fitting steel rivets. Pipes shall be straight and painted flat black.

2. A safety-yellow batten cap shall be installed at each end of each pipe batten.

3. The manufacturer shall provide four self-adhesive labels for each batten on which the rated batten load shall be written by the installer.

4. Chain used for dead hung suspension shall be zinc plated NACM, Grade 30 proof coil chain with ¼" shackle and 1 ½" Grad 5 safety bolt. Top and bottom attachment shall be made via a wrap and a half of chain with shackle and safety bolt. Hardware shall be US made and be stamped with safe working load.

5. Bottom attachment with rated Crosby shackle to the connector strip hangar bracket will be acceptable for all electrics with connector strips.

XI. PORTABLE ELECTRICAL DISTRIBUTION EQUIPMENT (STAGES OFF OF GYMNASIUMS)

A. A self-contained connector strip/dimmer bar unit shall be provided for mounting on a free standing tripod lighting tree support stand.

1. The dimmer bar shall be the SmartBar 2 as manufactured by Electronic Theatre Controls, Inc. (ETC), or equal. SmartBars shall be portable linear forward-phase (SCR) dimmer bars that allow Theatrical Lighting Instruments to be mounted on them.

2. The SmartBars shall be available with current ratings of maximum 10 Amps per output circuit for a maximum of 20 Amps per incoming phase of power.

3. Installation requires attachment for suspension points, safety cables, local main power via a flexible cable, and DMX signal input.

B. Mechanical:

1. The dimmer bar shall be a self-contained unit, suitable for portable or permanent installation. It shall be constructed of aircraft quality powder coated aluminum.

2. All dimmer bars shall be convection cooled and shall operate without cooling fans or filters.

3. The bar shall have integrated suspension points for fixtures and for mounting hardware(c-clamps or stand adapters). It shall be supplied with five 4-1/2" long, ½" bolts and appropriate hardware.

4. Integrated suspension points shall provide captive nylon bushings for ease of swivel focus of fixtures after mounting bolts have been tightened.

5. The 2 circuit dimmer bar shall measure 3.0 x 2.0 x 40 inches and weigh no more than 14 lbs. The 4 circuit dimmer bar shall measure 3.0 x 2.0 x 60 inches and weigh no more than 18 lbs. The 6 circuit dimmer bar shall measure 3.0 x 2.0 x 88 inches and weigh no more than 28 lbs.

C. Electrical:

1. Power wiring to each module shall be connected by use of a 12’ flexible SO Top or bottom fed cord and connector. Use of flexible feed cords and connectors facilitates the reconfiguration of both permanent and portable dimming equipment installations. Each bar shall be powered by a power feed service according to its current rating.

    a) Four (4) circuit, single phase 2-wire plus ground, 20A feed.

2. Fully magnetic circuit breakers shall be used for load protection.

3. Output connectors shall be Grounded Stage Pin connectors.

4. A single duplex outlet shall be provided as a convenience power outlet.

D. Control:

1. The front panel shall contain DMX512 Input and Thru connectors. The module shall support up to 32 Power Modules on one DMX line.

2. The Bar shall support ANSI E1.20 Remote Device management (RDM).

3. Dimmer control electronics shall be contained within the dimmer bar. The electronics shall include the following indicators and controls:

    a) Two status LED indicators: Power and Valid DMX.

    b) 2-line by 20-character backlit LCD for system configuration, status display and error indication.

    c) 6-button keypad with arrow array which includes Enter button

4. The electronics shall provide flexible programming of individual dimmer characteristics:

    a) Local control or live manual control

    b) 20 pre-programmed chase sequences

    c) Selection of standard Dimmer Curves

    d) RDM programmable DMX patch

    e) RDM Identification

    f) Minimum levels

    g) Non-dim operation

E. Thermal:

1. All units shall be convection cooled and shall operate without cooling fans or filters. The pack shall operate safely in an environment having an ambient temperature between 32ºF (0ºC) and 104ºFC)(,40 and humidity between 10 - 90% (non-condensing).

2. Optimum cooling shall be when the units are mounted horizontally with the control panel vertical (or upright).

XII.

A. Provide four (4) SmartBar® 2 Linear Dimmer Bars, Model No. SB4-10-B.

XIII. PORTABLE LIGHTING SUPPORT STANDS (STAGES OFF OF GYMNASIUMS

A. Portable tripod lighting support stands shall be provided for mounting self- contained connector strip/dimmer bar units.

1. The support stand shall be the SmartStand™ as manufactured by Electronic Theatre Controls, Inc. (ETC), or equal.

2. The crank-up stand may be loaded with a dimmer bar and theatrical lighting instruments to provide lighting for temporary setups.

3. The heavy duty stand shall rise to a maximum height of 12’ (380cm) and shall raise and lower up to a maximum of 68 pounds (31 kg).

B. Mechanical:

1. The unit shall be manufactured of black anodized steel with a geared column. Three tubular sections, with diameters of 2.2” (55mm), 1.8” (45mm), and 1.5” (38mm) respectively, shall allow the stand to extend at an elevation of 1.7” (44mm) per handle turn. A fold-away hand crank shall be used for gradual height adjustment.

2. The geared column shall use a dual cable control process for safety. The dual cable control shall ensure simultaneous retrieval of all sections as height is adjusted.

3. The unit shall have three legs with stabilizers, each 1.2” (30mm) diameter. One leg shall be an articulating leg to level the stand when placed on uneven surfaces. The full stand base diameter shall be 65” (166cm).

4. A sturdy adjustable foot step shall be included on the base section of the stand.

5. An industry standard senior stud adapter shall be included (1-1/8” diameter stud with ½”–13 thread) for mounting accessories to the stand. The top head of the stand shall also have a 1-1/8” receiver and 5/8” retractable baby stud (standard television head).

6. The total folded length of the unit shall be 6’0” (182cm).

7. The weight of the stand shall be 49.5 lbs. (22.4 kg), and with casters, 58.5lbs. (26.5 kg).

C. Required:

1. The following options for the stand shall be provided:

a) An additional stand adapter (stud).

b) A set of three (3) locking casters – 3.9” (100mm) diameter casters with brakes.

D. Provide four (4) SmartStand Light Stands with Bar.

E. Each portable lighting support stand shall have three (3) black heavy duty nylon construction bags containing 25 pounds of sand for anchoring the tripod support stand.

F. Loose cables shall be provided as follows:

1. Four (4) 12/3 SO extension cables, 50 feet long, with a NEMA 5-15P plug on one end and a 20 amp female grounded stage pin connector on the other end.

2. Two (2) 12/3 SO extension cables, 25 feet long, with a NEMA 5-15P plug on one end and a 20 amp female grounded stage pin connector on the other end.

3. Four (4) DMX data cables, 50 feet long, with 5-pin XLR data line, male to female connectors. Type as recommended by the system manufacturer.

4. Four (4) DMX data cables, 10 feet long, with 5-pin XLR data line, male to female connectors. Type as recommended by the system manufacturer.

XIV. THEATRICAL LIGHTING INSTRUMENT PACKAGE

A. Theatrical lighting instruments manufactured by ELECTRONICS DIVERSIFIED, INC. (ETC), and ALTMAN are specified herein to provide a basis of quality. Other acceptable manufacturers are STRAND LIGHTING, INC.

1. Followspot lighting instruments shall be manufactured by STRONG ENTERTAINMENT LIGHTING.

B. Theatrical lighting instruments shall be capable of performing with tungsten halogen lamps and light emitting diodes (LED) as indicated herein with proper heat sink cooling. Phenolic materials shall be employed on the fixtures in order to protect the operator from potential burns.

C. Each theatrical lighting instrument shall be supplied with a malleable iron clamp to grip up to a two (2) inch ID pipe, a fixture yoke with locking clutch handle, and three (3) foot long SF2 leads in a fiberglass sleeve.

D. Minimum performance criterion for all theatrical lighting instruments shall be as herein specified. Each instrument shall be furnished with a three pole, grounded stage-pin (GSP) connector and safety cable. UL listing is required on all theatrical lighting instruments.

E. COLOR MIXING OR WHITE-LIGHT LIGHT EMITTING DIODE PROFILE FIXTURE

1. The fixture shall be a color-mixing high-intensity LED illuminator with DMX control of intensity and color. The fixture shall be a Source Four LED as manufactured by Electronics Theatre Controls, Inc. or approved equal.

2. All LED fixtures shall be provided by a single manufacturer to ensure compatibility.

3. The fixture shall be UL 1573 listed for stage and studio use.

4. The fixture shall comply with the USITT DMX-512A standard.

5. Physical

a) The unit shall be constructed of rugged, die cast aluminum, free of burrs and pits, finished in black.

b) The following shall be provided:

(1) Lens secured with silicone shock mounts
(2) Shutter assembly shall allow for +/-25 rota tion

(3) 20 gauge stainless steel shutters

(4) Interchangeable lens tubes for different field angles with Teflon guides for smooth tube movement

(5) Sturdy integral die cast gel frame holders with two accessory slots, and a top-mounted, quick release gel frame retainer

(6) Rugged steel yoke with two mounting positions allowing 300+ rota tion of the fixture within the yoke

(7) Positive locking, hand operated yoke clutch

(8) Slot with sliding cover for motorized pattern devices or optional iris

c) The housing shall have a rugged black powder coat finish

(1) White or silver/gray powder coat finishes shall be available as color options

(2) Other powder coat color options shall be available on request

d) Power supply, cooling and electronics shall be integral to each unit.

e) The unit shall ship with:

(1) Theatrical-style hanging yoke as standard

(2) 5’ Neutrik PowerCon™ to Edison power cable as standard

(3) Gate diffuser

(4) A-size pattern holder

f) Available options shall include but not be limited to:

(1) Bare-end, Stage-Pin or Twist-lock type-equipped power leads

(2) PowerCon to PowerCon cables for fixture power linking

(3) Smooth Wash Diffuser for overlapping beams of light from multiple fixtures

6. Optical

a) The light beam should have a 2-to-1 center-to-edge drop-off ratio

b) The unit shall provide, but not be limited to:

(1) Low gate and beam temperature

(2) Sharp imaging through a three-plane shutter design

c) The unit shall provide, but not be limited to:

(1) 5, 10, 14, 19, 26, 36, 50, 70 and 90 degree field angles

(2) High-quality pattern imaging

(3) Sharp shutter cuts without halation

(4) Shutter warping and burnout in normal use shall be unacceptable

(5) Adjustable hard and soft beam edges

d) 19, 26, 36, and 50 degree units shall have optional lens tubes available for precision, high-contrast imaging.

7. Environmental and Agency Compliance

a) The fixture shall be ETL and cETL LISTED and/or CE rated, and shall be so labeled when delivered to the job site.

b) The fixture shall be UL LISTED to the UL1573 standard for stage and studio use

c) The fixture shall be rated for IP-20 dry location use.

8. Thermal

a) Fixture shall be equipped with a cooling fan.

(1) Fan speed control via a DMX channel shall be possible

(2) Fan speed software shall permit the fixture to override DMX fan speed setting to prevent heat damage to the fixture

b) The fixture shall utilize advanced thermal management systems to maintain LED life to an average of 70% intensity after 50,000 hours of use

(1) Thermal management shall include multiple temperature sensors within the housing to include:

c) LED array circuit board temperatures

d) Temperature sensors placed on each individual LED color circuit

e) Fixture ambient

f) CPU

(1) Fixture user shall permit monitoring of temperature sensors via a legible LCD multi-line backlit display

(2) Fixtures that do not provide active thermal monitoring of LED circuits and other temperature readings shall not be acceptable

g) The fixture shall operate in an ambient temperature range of - 20°C (-4°F) minimum, to 40° C (104°F) maximum ambient temperature.

9. Electrical

    a) The fixture shall be equipped with a 100V to 240V 50/60Hz internal power supply

    b) The fixture shall support power in and thru operation

        (1) Power in shall be via Neutrik® PowerCon™ input connector

        (2) Power thru shall be via Neutrik ® PowerCon ™ output connector

        (3) Fixture power wiring and accessory power cables shall be rated to support linking of multiple fixtures up to the capacity of a 15A breaker

    c) The fixture requires power from a non-dim source

    d) Power supply outputs shall have self-resetting current-limiting protection

    e) Power supply shall have power factor correction

10. LED Emitters

    a) The fixture shall contain a minimum of five different LED colors to provide color characteristics as described in the Color Section below.

    b) All LEDs used in the fixture shall be high brightness and proven quality from established and reputable LED manufacturers.

        (1) Fixture shall utilize Luxeon® Rebel™ LED emitters

    c) Manufacturer of LED emitters shall utilize an advanced production LED binning process to maintain color consistency.

    d) LED emitters should be rated for nominal 50,000-hour LED life to 70% intensity

    e) All LED fixtures (100% of each lot) shall undergo a minimum eight-hour burn-in test during manufacturing.

    f) LED system shall comply with all relevant patents

11. Calibration

    a) Fixture shall be calibrated at factory for achieve consistent color and

intensity output between fixtures built at different times and/or from different LED lots or bins

(1) Calibration data shall be stored on the LED array as a permanent part of on-board operating system

(2) All arrays, including replacement arrays shall be calibrated to the same standard to insure consistency

(3) Fixtures not offering LED calibration shall not be acceptable

12. Color

a) The fixture shall utilize a minimum of 60 LED emitters

b) Source Four LED Lustr+

(1) Red, Amber, Green, Cyan, Blue, Indigo and White LEDs in an array designed for broad spectrum color, light tints, and variable whites. This array shall be the Lustr+ array as manufactured by Electronic Theatre Controls, or approved equal

c) Measured brightness of the Lustr+ array shall be greater than 4,000 field lumens

13. Dimming

a) The LED system shall use 15-bit nonlinear scaling techniques for high-resolution dimming.

b) At least four different dimming curve options shall be accessible at the fixture's User Interface

(1) Incandescent

(2) Standard

(3) Linear

(4) Quick

c) Dimming curves shall be optimized for smooth dimming over longer timed fades.

d) The LED system shall be digitally driven using high-speed pulse width modulation (PWM)

e) LED control shall be compatible with broadcast equipment in the following ways:

(1) PWM control of LED levels shall be imperceptible to video cameras and related equipment

(2) PWM rates shall be adjustable by the user at the fixture if necessary to avoid any visible interference to video cameras and related equipment

14. Control and User interface

a) The fixture shall be USITT DMX 512A-compatible via In and Thru 5-pin XLR connectors

b) The fixture shall be compatible with the ANSI RDM E1.20 standard

(1) All fixture functions shall accessible via RDM protocol for modification from suitably equipped control console

(2) Temperature sensors within the luminaire shall be viewable in real time via RDM

(3) Fixtures not offering RDM compatibility, feature set access or temperature monitoring via RDM shall not be compatible

c) The fixture shall be equipped with multi-line LCD display for easy-to-read status reports and configuration changes

d) The fixture shall be equipped with a six-button user-interface

e) The fixture shall offer multiple DMX input profile options to include:

(1) RGB - control of all individual LED colors via a three- channel profile

(a) Red, Green, Blue

(2) HSI – control of all individual LED colors via a three- channel profile

(a) Hue, Saturation, Intensity

(3) HSIC – control of all LED colors via a four-channel profile

f) Hue, Saturation, Intensity and Color Point

(a) Color point provides variable color temperature settings

(2) Direct – control of each individual color channel via an independent channel

(3) Studio – Control of the fixture in a white-light 3 channel profile

g) Intensity, Color Temperature, +/- Green (Tint)

(a) Without DMX the fixture can master other Source Four LEDs and Desire fixtures that are connected via 5 pin XLR DMX cables

(2) A variable-rate strobe channel shall be provided

h) The fixture shall offer three output settings

(1) Boost mode - powers LEDs at maximum intensity and provides no compensation against LED 'droop' or intensity loss

(2) Regulated mode – slightly restricts maximum LED intensity levels to compensate against LED droop

(3) Protected mode – further restricts maximum LED intensity levels to compensate against LED droop and offer color consistency at highest permissible ambient temperatures (40C)

(4) Fixtures that do not provide regulated and protected operation modes are not acceptable

i) The fixture shall offer additional user-definable options to including but not limited to:

(1) Display time out options

(2) Loss of data behavior options

(3) White point settings

(4) Red-shift option for tungsten dimming emulation

j) The fixture shall offer five Quick Set-Ups to allow user to rapidly select different combinations of the numerous user options based on the desired usage situation, to include:

(1) General – for most situations

(2) Stage – when emulating incandescent fixtures is desired

(3) High Impact – when maximum output and effect is desired

(4) XT Arch – when color consistency and architectural characteristics are desired.

(5) Studio - when DMX or stand-alone of white light output is required with intensity, color temperature and color tint control parameters

k) The fixture shall offer stand-alone functionality eliminating the need for a console

(1) Fixture shall ship with 24 preset colors accessible as a stand-alone feature

(2) Fixture shall ship with 12 sequences accessible as a stand-alone feature

(3) Each color and sequence can be modified by the end user

(4) Fixtures can be linked together with standard DMX cables and controlled from designated master fixture

l) Up to 32 fixtures may be linked

(1) Fixtures in a stand-alone state shall restore to the settings present prior to power cycling, eliminating the need for reprogramming

(2) Fixtures without stand-alone operation features described above shall not be acceptable.

m) The fixture shall be capable of copying all performance settings to other fixtures of the same type via a 5 pin XLR DMX cable

n) Provide sixteen (16) LED Ellipsoidal Lustr+ with 26° Enhance Definition Lens Tube

F. 2.5 WATT COLOR MIXING LIGHT EMITTING DIODE FIXTURE:

1. The fixture shall be a broad-spectrum color-mixing LED illuminator with DMX control of intensity as well as color changing. The fixture shall be a Vivid-R as manufactured by Electronics Theatre Controls, Inc. or approved equal.

2. All LED fixtures shall be provided by a single manufacturer to ensure compatibility.

3. The fixture shall comply with USITT DMX-512 A.

4. Physical

    a) The unit shall be black in color and contained in a rugged all-metal extruded and formed-metal housing, free of burrs and pits.
    b) Power supply, cooling and electronics shall be integral to each unit.

    c) The unit shall provide, but not be limited to:

        (1) 1/2” Mounting bolts on each end

        (2) 5’ power lead with Edison connector

        (3) Easy-access slots for secondary lenses for varied beam spreads

        (4) Optional yoke (11” and 21” only), trunnion, and hanging bracket mounting kits.

        (5) Bare-end, Stage-Pin or Twist-Loc power leads shall be available

    d) The unit shall be 21.5in (547mm) long by 7.1in (180mm) high by 7.1in (180mm) deep with a weight of 20 lbs (9.1 kg) not including mounting hardware

5. Environmental and Agency Compliance

    a) The fixture shall operate in an ambient temperature range of 0°C minimum, to 40° C (104°F) maximum ambient temperature. The fixture shall be rated for IP-20 dry location use.

    b) The fixture shall utilize advanced thermal management systems for long LED life

    c) The fixture shall provide on-board fan speed control

    d) LED fixture housing shall be designed to transfer heat from the LED board to the outside environment.

    e) The fixture shall be ETL and cETL LISTED, and shall be so labeled when delivered to the job site. The fixture shall be ETL LISTED to UL1573.

6. ELECTRICAL

    a) The fixture shall be equipped with 100V to 240V 50/60 Hz internal power supply

b) The fixture shall receive power via Neutrik® PowerCon™ input connector

c) The fixture requires power from non-dim source

d) Power/data supply outputs shall have current limiting protection.

e) Power/data supply shall provide miswiring protection.

f) Power/data supply shall have power factor correction.

g) Power/data supply shall be UL listed for Class 1 or Class 2 wiring

h) Power/data supply shall come with a housing that meets a minimum IP20 rating for dry location installation

7. LED Emitters

a) The fixture shall utilize red, red-orange, amber, green, cyan, blue, and indigo emitters for maximum spectral output.

b) All LEDs used in the LED fixture shall be high brightness and proven quality from established and reputable LED manufacturers.

c) Manufacturer of LED systems shall utilize an advanced production LED binning process to maintain color consistency.

d) LED emitters should be rated for nominal 50,000 hour LED life

e) The fixture shall utilize Luxeon® Rebel™ 2.5W LED emitters

f) All LED fixtures (100% of each lot) shall undergo a minimum eight-hour burn-in test during manufacturing.

g) LED system shall comply with all relevant patents.

8. COLOR

a) The fixture shall utilize the exclusive x7 Color System™ 7-color LED array

(1) Each 11” cell shall contain 40 LEDs

(2) Each 11” cell shall contain seven different colors of LED emitters for maximum spectral output

b) The fixture shall optimized for excellent pastel and saturated colors

c) The LED system shall be capable of at least 15-bit control of each color level in each cell for greater than 1 billion possible color combinations.

d) The fixture shall interact seamlessly with conventional sources

e) The fixture shall render light tints and skin tones similar to tungsten-sourced fixtures.

9. CONTROL

a) Each 11” cell of every fixture shall have the capability to be set to a unique and individual address.

(1) 21” fixture provides 2 independently controlled cells

b) The fixture shall be DMX 512 compatible via In and Thru 5-pin XLR connectors

c) The LED system shall be digitally driven using high-speed pulse width modulation (PWM).

d) LED control shall be compatible to broadcast equipment

(1) PWM control of LED levels shall be imperceptible to video cameras and related equipment

e) Each 11” cell of every fixture shall provide 8 channel control (7 color plus intensity)

(1) An intensity channel shall be utilized for each cell to minimize color shift during dimming.

f) The LED system shall use 15-bit nonlinear scaling techniques for high-resolution dimming.

g) Dimming curves shall be optimized for smooth dimming at low intensities and over longer timed fades.

10. Provide eight (8) Vivid 21” LED fixtures with lens set.

G. Color Mixing Light Emitting Diode (LED) Wash Fixtures:

1. The lighting instruments (fixture) shall be a color-mixing high-intensity LED illuminator with DMX control of intensity and color. The fixtures shall be Desire D40 as manufactured by Electronics Theatre Controls, Inc. or approved equal.

2. The LED lighting instrument shall be UL 1573 listed for stage and studio use and shall comply with USITT DMX-512 A standard.

3. The LED lighting instrument shall be contained in a rugged all-metal die- cast housing, free of burrs and pits and shall have a black powder coat finish. Power supply, cooling and electronics shall be integral to each unit.

4. The LED lighting instrument shall have two (2) easy-access slots for secondary lenses and other accessories. The slots shall be equipped with locking retaining clips.

5. The LED lighting instrument shall include, but not be limited to:

    a) Theatrical –style hanging yoke.

    b) 25 deg. secondary lens.

    c) Five (5) foot power lead with grounded stage-pin connector.

    d) Yoke with floor stand conversion feature.

    e) PowerCon to PowerCon cables for fixture power linking.

    f) Multiple secondary lens options to include multiple angles in the following patterns:

        (1) Linear

        (2) Round

        (3) Oblong

6. Light output shall be via a round aperture. Aperture and accessory slots shall accommodate standard 7.5” accessories such as used in other similar-sized fixtures. Accessories available as options shall include but not be limited to:

    a) Gel/diffusion frames

    b) Top hats

    c) Barndoors

    d) Egg crate louvers

    e) Concentric ring louvers

    f) Multiple secondary lensing options

7. Thermal:

a) The fixture shall be totally convection cooled, requiring no cooling fan. Fixtures which require an on-board cooling fan shall not be acceptable unless pre-approved.

b) The fixture shall utilize advanced thermal management systems to maintain LED life to an average of 70% intensity after 50,000 hours of use.

(1) Thermal management shall include multiple temperature sensors within the housing to include:

(a) LED array circuit board temperatures.

(b) Temperature sensors placed on each individual LED color circuit.

(c) Fixture ambient.

(d) CPU.

(2) Fixture user shall permit monitoring of temperature sensors via a legible LCD multi-line backlit display.

(3) Fixtures that do not provide active thermal monitoring of LED circuits and other temperature readings shall not be acceptable.

(a) The fixture shall operate in an ambient temperature range of -20°C (-4°F) minimum, to 40° C (104°F) maximum ambient temperature.

8. Electrical:

a) The fixture shall be equipped with 100V to 240V 50/60 Hz internal power supply.

b) The fixture shall support power in and thru operation.

(1) Power in shall be via Neutrik® PowerCon™ input connector.

(2) Power thru shall be via Neutrik ® PowerCon ™ output connector.

(3) Fixture power wiring and accessory power cables shall be rated to support linking of multiple fixtures up to the capacity of a 15A breaker.

c) The fixture requires power from non-dim source.

d) Power supply outputs shall have self-resetting current limiting protection.

e) Power supply shall have power factor correction.

9. LED Emitters:

a) The fixture shall contain a minimum of 5 different LED colors to provide color characteristics as hereinafter described.

b) All LEDs used in the fixture shall be high brightness and proven quality from established and reputable LED manufacturers.

(1) Fixture shall utilize Luxeon® Rebel™ LED emitters.

c) Manufacturer of LED emitters shall utilize an advanced production LED binning process to maintain color consistency.

d) LED emitters should be rated for nominal 50,000 hour LED life to 70% intensity.

e) All LED fixtures (100% of each lot) shall undergo a minimum eight-hour burn-in test during manufacturing.

10. Calibration – Fixtures shall be calibrated at factory the for achieve consistent color and intensity output between fixtures built at different times and/or from different LED lots or bins.

a) Calibration data shall be stored on the LED array as a permanent part of on-board operating system.

b) All arrays, including replacement arrays shall be calibrated to the same standard to insure consistency.

c) Fixtures not offering LED calibration shall not be acceptable.

11. Color – The fixture shall utilize a minimum of 40 LED emitters.
a) DESIRE D40

(1) Red, Amber, Green, Cyan, Blue, Indigo and White LEDs in an array designed for broad spectrum color, light tints, and variable whites. This array shall be the Lustr+ array as manufactured by Electronic Theatre Controls, or approved equal.

b) Measured brightness of the Lustr+ array shall be greater than 2900 field lumens

12. Dimming:

    a) The LED system shall use 15-bit nonlinear scaling techniques for high-resolution dimming. At least four different dimming curve options shall be accessible at the fixture's User Interface.

        (1) Incandescent

        (2) Standard

        (3) Linear

        (4) Quick

    b) Dimming curves shall be optimized for smooth dimming over longer timed fades.

    c) The LED system shall be digitally driven using high-speed pulse width modulation (PWM).

    d) LED control shall be compatible with broadcast equipment in the following ways:

        (1) PWM control of LED levels shall be imperceptible to video cameras and related equipment.

        (2) PWM rates shall be adjustable by the user at the fixture if necessary to avoid any visible interference to video cameras and related equipment.

13. Control and User Interface:

    a) The fixture shall be USITT DMX 512A-compatible via In and Thru 5-pin XLR connectors.

    b) The fixture shall be compatible with the ANSI RDM E1.20 standard.

        (1) All fixture functions shall accessible via RDM protocol for modification from suitably equipped control console.

        (2) Temperature sensors within the luminaire shall be viewable in real time via RDM.

    c) Fixtures not offering RDM compatibility, feature set access or temperature monitoring via RDM shall not be compatible.

    d) The fixture shall be equipped with multi-line LCD display for easy-to-read status reports and configuration changes.

e) The fixture shall be equipped with a six-button user-interface.

f) The fixture shall offer multiple DMX input profile options to include:

(1) RGB – control of all individual LED colors via a three- channel profile.

(a) Red, Green, Blue.

(2) HIS – control of all individual LED colors via a three- channel profile.

(a) Hue, Saturation, and Intensity.

(3) HSIC – control of all LED colors via a four-channel profile.

(a) Hue, Saturation, Intensity and Color Point.

g) Color point provides variable color temperature settings.

(1) Direct – control of each individual color channel via an independent channel.

(2) A variable-rate strobe channel shall be provided.

h) The fixture shall offer three output setting:

(1) Boost mode - powers LEDs at maximum intensity and provides no compensation against LED ‘droop’ or intensity loss.

(2) Regulated mode – slightly restricts maximum LED intensity levels to compensate against LED droop.

(3) Protected mode – further restricts maximum LED intensity levels to compensate against LED droop and offer color consistency at highest permissible ambient temperatures (40C).

(4) Fixtures that do not provide regulated and protected operation modes are not acceptable.

i) The fixture shall offer additional user-definable options to including but not limited to:

(1) Display time out options.

(2) Loss of data behavior options.

(3) White point settings.

(4) Red-shift option for tungsten dimming emulation.

j) The fixture shall offer five Quick Set-Ups to allow user to rapidly select different combinations of the numerous user options based on the desired usage situation, to include:

(1) General – for most situations.

(2) Stage – when emulating incandescent fixtures is desired.

(3) High Impact – when maximum output and effect is desired.

(4) XT Arch – when color consistency and architectural characteristics are desired.

(5) Studio - when DMX or stand-alone of white light output is required with intensity, color temperature and color tint control parameters.

k) The fixture shall offer stand-alone functionality eliminating the need for a console.

(1) Fixture shall ship with 24 preset colors accessible as a stand-alone feature.

(2) Fixture shall ship with 12 Sequences accessible as a stand-alone feature.

(3) Each color and sequence can be modified by the end user.

(4) Fixtures can be linked together with standard DMX cables and controlled from designated master fixture.

(5) Up to 32 fixtures may be linked.

(6) Fixtures in a stand-alone state shall restore to the settings present prior to power cycling, eliminating the need for reprogramming.

(7) Fixtures without stand-alone operation features hereinbefore described shall not be acceptable.

14. The Theatrical Lighting Instruments shall be ETC D40 LED lighting instruments. This Contractor shall furnish the following types and quantities of LED lighting

instruments with C-clamp, safety chain and full lens sets:

a) Provide fourteen (14) Desire D40™ Lustr+

H. Followspots:

1. The basis of this design shall be the Canto 250HR follow spotlight, as marketed by Strong Entertainment Lighting of Omaha, Nebraska.

2. The unit frame and enclosure shall be constructed of formed cold rolled steel and sturdy aluminum extrusions, free of burrs and protected by a black powder coat finish.

3. Handles shall be provided to facilitate smooth operation and to lift the unit.

4. The unit shall be mounted on a stable, folding three-point floor stand, with:

   a) Easy height adjustments,

   b) Horizontal Swing Control Lever and

   c) Vertical Tilt Control Lever

5. The Power Supply shall be integral to the followspot.

6. Weight of Head, including power supply, shall not exceed 34 pounds.

7. Length of head unit with color changing boomerang shall not exceed 41”.

8. A sliding panel shall provide access to lenses without the use of tools.

9. Controls

   a) The Lamphouse shall as a minimum incorporate the following:

10. Silent Fan Free air cooling system;

11. Drop-down single ended lamp holder to permit bulb replacement without the use of hand tools;

12. Bulb positioning controls.

    a) The body of the unit shall, as minimum incorporate the following:

13. Optical dimmer iris mechanism for smooth manual dimming;

14. Four shutters mounted on two planes, for both vertical and horizontal masking

15. Drop-in Nichrome steel iris

16. Drop-in Gobo Holder

17. Zoom focus controls with calibrations silk screened on followspot body.

    a) With the iris fully open this followspot shall be capable of producing a continuous range of field angles from 10.6 degrees in spot to 19.2 degrees in flood.

    b) At any field angle the beam shall be adjustable between soft and sharp edges.The front of the unit shall house a five color, self-canceling boomerang with color filters

18. Optical

    a) The unit's optical train shall consist of

        (1) Socket mounted 250 watt single-ended ceramic lamp, with the following features:

    b) 3,200°K color temperature;

    c) CRI greater than 90;

    d) Hot restrike;

        (1) 4,000 hour average life.

        (2) Fixed Optical Quality glass reflector and double condenser lens.

        (3) Variable focus lens system utilizing Optical-quality glass;

        (4) Iris/Gobo Holder, Shutters for beam shaping control;

        (5) Optical dimmer Iris;

        (6) Five color boomerang.

    e) The zoom focus shall increase light intensity as it decreases the spot diameter.

19. Electrical

    a) Lamp system input shall be 90-265 V.AC, 50/60 Hertz, single phase.

    b) Lamp shall be ST 250HR as manufactured by Philips, or approved

equal.

c) A double microswitch interlock shall be provided for safe lamp replacement.

20. Performance

a) Adjusted for flat field (approximately 70%) the unit shall produce a continuous range of illumination from 136,800 beam candlepower in Flood focus to 277,200 beam candlepower in Spot focus.

b) The Field diameter at a 60 foot throw shall be continuously adjustable from 20.3 feet in Flood focus to 11.2 feet in Spot focus. With full iris the Field diameter in spot focus shall be less than 15”.

c) Furnish two (2) #10857070 Canto 250 HR followspots, complete with Lamp, Iris, Gobo Holder, Color Changer, Stand and all necessary accessories.

Part 3 - Execution

XV. INSTALLATION

A. All wiring for lighting and control system shall be run in minimum ¾” conduit as hereinbefore specified. All junction box covers shall be identified as hereinbefore specified. All conduits, device mounting boxes, junction boxes, and enclosures shall be securely fastened with appropriate fittings to insure positive ground throughout the entire system.

B. This Contractor shall furnish and install all wiring and make all final connections as indicated in the system manufacturer’s shop drawings and standard installation documents. Splices for dimming circuits shall be made only in junction boxes.

C. All wiring shall be checked and tested by this Contractor to ensure the system is free from grounds, opens, and shorts.

D. All work shall be under the supervision of a field engineering technician, accredited by the system manufacturer. It shall be the responsibility of this technician to check and inspect the installation to the Owner's and Architect/Engineer's satisfaction. This technician shall also provide a minimum of four (4) hours of training for the Owner's operating personnel on the proper operation and maintenance of the lighting control system equipment.

XVI. OPERATING AND MAINTENANCE INSTRUCTIONS

A. At the completion of the installation, the manufacturer shall furnish four (4) final sets of "as-built" drawings as well as manuals of instruction as to the proper operation and maintenance of the lighting control system. “As built” drawings shall include all field

modifications. Formal turn-on and instruction shall be provided to the Owner's officially designated representative within fourteen (14) days of a written request by the Owner.

B. This Contractor shall furnish the Owner's officially designated representative(s) with a minimum of three (3) hours of on-the-job instructions in the operation, maintenance, and diagnostic testing of the system. (This shall not be part of the system turn-on specified above.) This Contractor shall also furnish the Architect/Engineer four (4) bound copies of complete operating and maintenance instruction manuals of the lighting control system including circuit diagrams and all other information necessary for proper operation and service maintenance.

XVII. SYSTEM TEST

A. This Contractor shall conduct an operating test of the complete system. The system shall test free from grounds, shorts, and other faults. All connections shall be thoroughly checked for mechanical and electrical connections. All lighting control system equipment shall be demonstrated to operate in accordance with the requirements set forth in these Specifications and as shown on the Drawings.

B. This Contractor shall perform all tests in the presence of the Architect/Engineer. This Contractor shall furnish all personnel and test instruments for use in the test.

XVIII. WARRANTY

A. This Contractor shall deliver the work in a first-class operating condition in every respect.

B. This Contractor shall warrant that the material, equipment, and workmanship furnished shall be entirely free from defects. Any material, equipment, or workmanship in which defects may develop before or during the warranty period shall be repaired or replaced at the Contractor's own expense. Refer to SECTION 01740 for the start of the warranty period. The Contractor shall further warrant that all material, equipment, and workmanship used in the installation, but not specifically mentioned in the Drawings and Specifications, is the best of their respective kinds and that the construction and installation was performed in accordance with the best accepted standard practices in all details.

C. All materials used shall be new and of good quality conforming to these specifications and the successfully reviewed submittals. Any material not successfully reviewed by the Architect/Engineer that is incorporated in the work, used or delivered to the site, shall be immediately removed upon the order of the Owner or Architect/Engineer and replaced to the satisfaction of the Architect/Engineer at this Contractor's expense.

D. It shall be this Contractor’s responsibility to include costs incurred in other trades for any work disarranged by such replacements described above. This will include replacement of work and damaged equipment during the progress of construction.

E. The lighting control system manufacturer shall be prepared to offer a service contract

for the maintenance of the system after the warranty period.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include the materials and equipment necessary for this Contractor to furnish and install a performance lighting control system(s), wiring devices and performance lighting instruments herein specified for the black box theater. It shall also include the services of qualified field engineer/technicians regularly employed by the manufacturer of the system(s) who shall review the installation(s) to ensure its proper operation and provide Owner training.

B. The Black Box Theater Performance Lighting Systems and Controls shall be furnished by a factory authorized Theatrical Contractor/Distributor certified to design, program and service the systems. The Theatrical Contractor shall be responsible for coordination between the electrical installation and other trades installing theatrical equipment and for control terminations, system startup, system training, and warranty repair. A Theatrical Contractor is defined as a dealer who regularly engages in the sale and installation of theatrical supplies and equipment. The Theatrical Contractor/Distributor must show evidence of successfully furnishing theatrical systems specified for at least five (5) years.

C. This Contractor shall furnish and install all necessary equipment as hereinafter detailed for a complete and functional performance lighting control system(s) including the theatrical lighting instruments. Although not every component is called out in every detail, it shall be the responsibility of the manufacturer providing the system to assure that the intended function is furnished.

D. The system specified herein shall consist of a dimmer-per-circuit high density dimming system equipment panel, performance lighting control console, network based signal distribution system, distribution equipment, performance lighting instruments, and all required interconnecting wiring.

E. This Contractor shall furnish and install in accordance with the lighting control manufacturer's instructions, all conduits, wiring, and outlet boxes required for the erection and operation of the complete system(s) as herein specified and as shown on the Drawings.

F. The Black Box Theater performance lighting control system shall be supplied as a single integral unit with all dimmer modules, control circuits, circuit breakers, and the like factory wired. Field wiring shall consist of connecting input feeders, dimmer circuits, and remote control wiring to the distribution devices and control console.

G. It is the intention of this specification section that the entire Black Box Theater performance lighting control system be available to all bidders and not “Packaged or Bundled” with any other lighting systems or equipment.

III. DEFINITIONS

A. The term “furnish” means to supply and deliver to the job site, ready for unloading, unpacking, assembly, installation, and similar operations.

B. The term “install” is used to describe operations at the job site including the actual anchoring, applying, assembling, cleaning, curing, cutting, erection, finishing, patching, placing, protecting, pulling, terminating, unloading, unpacking, working to dimension, and similar operations that will render the systems complete and ready for the intended use.

C. DMX: Digital Multiplexing

IV. SUBMITTALS

A. Provide three (3) submittals in accordance with General and Special Conditions. Submit submittals in a timely manner, allowing sufficient time for adequate review and possible resubmittal without jeopardizing the project schedule.

1. Submittals shall include: full system riser diagrams, a full set of printed technical data sheets, and any additional information as required by the owner to verify compliance with specifications.

B. Manuals:

1. Operations and Maintenance Manuals shall include:

a) Contact information for pertinent manufacturers

b) Safety and Operational Instructions

V. QUALITY ASSURANCE

A. The contractor shall furnish submittals for all components of the performance lighting and lighting control system(s) in accordance with SECTION 16010 of these Specifications. The submittals should include the manufacturers working drawings and shall include, but not be limited to the following:

1. Manufacturer's catalog data for all lighting instruments, equipment, and components that shall include all technical data to demonstrate conformance with these Specifications.

2. Complete physical drawings of all items of equipment showing dimensions, metal gauges, etc.

3. Complete load schedules which shall clearly indicate actual connected loads and control channel assignment (where applicable), cross- reference of internal equipment identifications to circuit numbers shown on the Drawings, and all other scheduled information which shall relate the equipment to the project requirements.

4. Complete internal and interconnection wiring diagrams showing number, size, and types of conductors between equipment and from equipment to loads, and feeder quantity and sizes.

B. All materials used shall be new and of good quality conforming to these specifications and the successfully reviewed submittals. Any material not successfully reviewed by the Architect/Engineer that is incorporated in the work, used or delivered to the site, shall be immediately removed upon the order of the Owner or Architect/Engineer and replaced to the satisfaction of the Owner and Architect/Engineer at this Contractor's expense.

1. It shall be this Contractor’s responsibility to include costs incurred in other trades for any work disarranged by such replacements described above. This will include replacement of work and damaged equipment during the progress of construction.

C. The lighting control system equipment specified herein shall be the sole responsibility of a single manufacturer. The manufacturer shall have been producing theatrical lighting and SCR type lighting control systems for at least fifteen (15) years.

D. All work shall be in accordance with good engineering practices. All equipment for this system shall be listed by Underwriter's Laboratories, Inc. (UL), bear the UL label, and shall be installed in accordance with all requirements of the National Electrical Code (NEC), state and local codes, and these Specifications.

E. The entire performance lighting control system shall be completely factory assembled and tested under load conditions prior to shipment of the system.

F. Existing system modifications only: Prior to any work being performed on the existing system, the entire performance lighting control system shall be completely tested under load conditions. The test shall include each device on the existing system. The Contractor shall certify the operating condition and report any abnormal conditions to the Owner.

VI. QUALIFICATIONS

A. Qualifications

1. Manufacturer: A firm who has been continuously engaged in the production of theatrical lighting and control equipment for at least fifteen (15) years and in the manufacture of theatrical dimming systems and dimmers for a minimum of ten (10) years.

2. Provider: Skilled technicians who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and best industry practices for the proper installation of the work.

B. The Contractor and the Theatrical Contractor/Distributor shall be required to furnish satisfactory proof of their competence as evidenced by successfully completed previous contracts where control equipment of this nature has been specified.

C. The Contractor is encouraged to visit the site, shall become familiar with the Drawings outlining this work, and shall become completely familiar with the various items of equipment being furnished under other Divisions of these Specifications related to this work. The Contractor shall make all necessary investigations relative to the conditions that may be encountered on this project.

VII. DELIVERY, STORAGE AND HANDLING

A. Deliver equipment and controls securely wrapped in factory fabricated wooden or fiberboard containers.

B. Handle equipment and controls carefully to prevent breakage, denting and scoring finish. Do not install damaged equipment and controls; replace and return damaged units to equipment manufacturer.

C. Acceptance at Site: Provider shall accept and inventory all equipment upon delivery and provide copies of the inventory to the owner.

D. Storage and Protection: Store equipment in a secure, environmentally controlled location. Place no equipment until that location is substantially complete, free from construction dust, and “broom clean”. Store in original cartons and protect from dirt, physical damage, weather, and construction traffic.

VIII. SPARE PARTS

A. This Contractor shall furnish to the Owner spare parts as follows. Spare parts shall be furnished prior to the installation of the system.

1. One (1) dual 2.4 kW dimmer module.

2. One (1) spare dimmer rack processor (Control Module).

B. This Contractor shall furnish to the Owner, at the completion of the project, 20% (minimum of two) spare lamps for each type and wattage of lamps used in the theatrical lighting instruments.

Part 2 - Products

I. MANUFACTURERS

A. The Black Box Theater lighting control system as shown on the Drawings and herein specified shall be as manufactured by ELECTRONIC THEATRE CONTROLS, INC. (ETC) [Sensor3™ System] as listed or the equivalent as manufactured by STRAND LIGHTING, INC. [A21 System] which must meet all of the requirements of these Specifications. The system shall utilize the manufacturer’s standard products and components with modifications as required meeting the construction and performance requirements of this section.

B. The theatrical lighting instruments as shown on the drawings and herein specified shall be as manufactured by ELECTRONIC THEATER CONTROLS INC. (ETC), as listed or the equivalents as manufactured by STRAND LIGHTING, INC., or DESISTI LIGHTING

which must meet all of the construction and performance requirements of these specifications.

II. DIMMING SYSTEM EQUIPMENT RACK

A. This Contractor shall furnish and install where shown on the Drawings, a Black Box Theater performance lighting dimming system equipment rack. The rack shall be ETC Sensor3 SR3-12 (12 module) Advanced Features wall mounted dimmer rack or equal.

B. Dimmer Rack Electrical:

1. The dimming system equipment rack shall be suitable for operation at 120/208 volt, three phase, four wire, + ground, sixty hertz, 200 amp, and have busing rated for 100% continuous duty, and suitable lugs for a single point connection. Sensor racks shall automatically compensate for frequency variations during operation. Standard SCCR fault current protection shall be 50,000A. Racks shall be UL listed with appropriate factory applied labels.

2. Load and neutral terminals shall be sized to accept up to two (2) sets of 250 kcmil conductors or other sizes and/or quantities of conductors as shown on the Drawings.

3. Load terminals shall be located at the front of the wiring cavity. Front access racks having terminals located at the back of the rack or on the side near the back of the rack such that adjacent load cabling may block terminal access shall not be acceptable.

C. Dimmer Rack Electronics:

1. Power control electronics (CEM3) shall be contained in a single module that must be plug-in capable without use of tools.

2. All data and power input for CEM3 control electronics shall be located on a separately removable/pluggable termination connector on the backplane such that backplane can be replaced without removal and discrete secondary conductor terminations. Dimming systems that require discrete termination of DMX, Ethernet, power input, and dimmer control output directly on terminals on the control module or pluggable backplane shall not be permitted.

3. The power controller shall directly support the following network protocols:

a) Net3 protocol suite including ANSI E1.31 Streaming ACN (sACN)

b) ANSI E1.17 Architecture for Control Networks (ACN)

4. Systems must support the above listed industry standard ACN protocols for Ethernet setup, control and feedback integrated directly between the power system and control system.

5. The power controller shall directly support 2 ports of control input using ANSI E1.11 USITT DMX512-A.

6. Dimming control signals must be sent between control module and dimmer/power modules using flat ribbon cables.

7. System must provide an optional low voltage connection to maintain power of control electronics through brown out, instantaneous, and sustained power outages.

8. Control electronics shall be housed in a formed steel body with cast- aluminum face panel.

D. Physical:

1. The Sensor3 dimmer rack shall be a wall mounted, dead-front switchboard, substantially framed and enclosed with 16 gauge, formed steel panels. All rack components shall be properly treated, primed and finished. Exterior surfaces shall be finished in fine-texture, scratch- resistant, gray epoxy paint. Knockouts in the top and bottom panels shall facilitate conduit termination on the rack.

2. Rack components shall be designed for easy removal and installation so that the dimming system equipment rack is completely open and empty during field wiring. Rear access to the rack for installation or servicing shall not be required. Racks shall be designed for front access to allow back-to-back, back-to-wall or side-by-side installation.

3. Racks shall be designed to allow easy insertion and removal of all modules without the use of tools. Supports shall be provided for precise alignment of dimmer modules into power and signal connector blocks. With modules removed, racks must provide clear front access to all load, neutral and control terminations.

4. An optional bus bar kit shall be available from the factory to allow adjacent racks to be powered by a single line feed. No hard, rack-to-rack wiring shall be required. Racks that require discrete cabling to connect adjacent racks shall not be acceptable.

5. Module spaces shall be mechanically keyed to accept only the 3kW or below, 5kW, or 10kW module specified for that space. The rack shall be configurable to accept mixed dimmer types and sizes throughout the rack.

6. Each rack shall provide a lockable full-height door containing an integral electrostatic air filter that shall be removable for easy cleaning. A single low-noise fan shall be located at the top of each rack. Design of the rack and dimmer modules shall draw all cool air intake air through the integral electrostatic air filter at the front of the rack, discretely through each module housing and directly out the top of the rack such that exhausted hot air from adjacent modules does not heat the module(s) above, below, or to the side of each other.

7. The fan shall maintain the temperature of all components at proper operating levels with dimmers under full load, provided the ambient temperature of the

dimmer room does not exceed 40°C/104°F. Dimmer racks that do not employ both locking doors and electrostatic air filters shall not be acceptable.

8. The fan shall turn on whenever any dimmer in the system is activated. In the event of an over-temperature condition, only the affected dimmer module(s) shall shut down and a message shall appear on the control module LCD. The fan shall remain on during thermal shutdown of individual dimmer modules. Systems must include over-temperature sensing and preventative thermal shutdown.

9. A fan sensor shall be provided. In the event of momentary fan failure, error message will be displayed and sent remotely over Ethernet to optional logging systems. Systems must provide optional system event logging.

10. If the ambient room temperature drops below 0°C/32°F or rises above 40°C/104°F, a warning shall appear on the dimmer rack LCD. If the temperature rises above 46°C/115°F, the rack shall shut down until the condition is corrected.

11. A 3 x 0.5-inch LED status indicator (beacon) shall be mounted in the rack door. The beacon shall be visible throughout a wide viewing angle. In normal operating conditions, this LED is illuminated. If the rack's control module senses an error condition, the beacon shall flash until the error is corrected. An optional indicator shall be available for remote locations. Racks must have external means of visually showing that an error is present.

E. Provide one (1) SR3 12AF Advanced Features Dimmer rack.

F. Provide an engraved nameplate on the front face of the dimmer rack in a suitable location. The nameplate shall be lettered BLACK BOX THEATER LIGHTING SYSTEM RACK.

III. POWER CONTROL ELECTRONICS

A. The dimmer rack electronics shall be contained in one (1) plug-in CEM3 Power Controller. Each power controller shall plug into the dimming cabinet with no need for tools or discrete wire connections. A simple user interface shall be provided for group configuration, testing and diagnostics. Power control shall be UL/cUL Listed and CE Marked. Removal of Power and Dimming Control electronics must be a tool free process.

1. The control electronics shall be contained in one plug-in module, housed in a formed steel body with cast-aluminum face panel, and self-retaining ejection handles to ease removal from the rack.

2. The power control shall automatically compensate for frequency variations during operation.

B. Power Control Interface:

1. A backlit eight-line by 20-character graphical LCD shall be provided for system

configuration, live control, and status display.

2. The following functional features shall be available in power control to reduce setup and tech times:

    a) Full number pad shall be provided for quick access to dimmers. Power Control must provide 0-9 number pad and logic keys for AND, THRU, and AT for fast access, selection, and control of circuit/dimmer number.

    b) Power control shall provide NEXT and LAST buttons to progress through circuits/dimmers during dimmer check operations such that only a single circuit is brought on to a level at a time during pre-show lighting checks for lamp burnouts.

    c) Shortcut buttons for Setup, About, and live control shall be provided for separation of functionality such that a user intending to check status or settings does not accidentally render their system unusable. These buttons shall also serve to reduce maximum time to access any feature or setting on a single dimmer, range of dimmers, or entire rack.

3. The front panel shall have five status LED indicators: power, network activity, DMX A, DMX B, and panic state.

4. Power control that does not include the above buttons and features shall not be acceptable.

C. Control Signal and Communications:

1. The power control shall be provided with an Ethernet control signal input. This input shall be fully configurable with a range of patching and priority programming capabilities. The Ethernet signal shall supply seamless integration between the dimmer racks and both the entertainment and architectural lighting control systems. The Ethernet signal shall also enable remote configuration, playback, file storage and monitoring features on a personal computer on the network. Dimming systems that require Ethernet to DMX translation devices for control of critical show lighting introduce a potential failure point and shall not be acceptable.

2. All data and power input for CEM3 control electronics shall be located on a separately removable/pluggable termination connector on the backplane such that the backplane can be replaced without removal and discrete secondary conductor terminations. Systems must support tool- less and not require removal of wires connected directly to the control electronics.

3. DMX connections shall be available with option for pluggable screw or punch-down type terminal. Systems must allow this option to support both DMX over CAT5 and multi-strand conductors.

4. Ethernet connection shall be available via standard Cat5 RJ45 connection. System requiring punch down direct to rack or controller cannot be Cat5 system certified and shall not be acceptable.

5. Dimming systems that require discrete termination of DMX, Ethernet, power input, and dimmer control output directly on terminals on the power control or pluggable backplane shall not be acceptable.

6. The following options shall be provided to backup all controller setup UL924 Panic configuration, and recorded presets:

    a) Automatic backup in non-volatile backplane memory.

    b) Automatic backup in non-volatile Controller memory.

    c) USB storage device pluggable on the controller face panel.

    d) Data shall also be transferable to and from library storage on a personal computer on a per-rack basis.

7. The power controller shall directly support the following network protocols:

    a) Net3 protocol suite including ANSI E1.31 Streaming ACN (sACN).

    b) ANSI E1.17 Architecture for Control Networks (ACN).

8. The power control shall directly support two (2) optically isolated ports of ANSI E1.11 USITT DMX512-A for control input. Minimum 2,500V of optical isolation shall be provided between the DMX512 inputs and the electronics. Systems having optical isolation on a prewired factory plug-in device shall not be acceptable.

9. Systems must support the above listed industry standard ACN protocols for Ethernet setup, control, and feedback integrated directly between the power system and control system.

D. Power Control Features:

1. Power Control shall have a dimmer update rate better than 16ms (60HZ) or 20 ms (50 Hz) average. Dimmer outputs shall exhibit no oscillating or hunting for levels. Dimmers with the same choke type set to the same level shall output within ±1V of each other, regardless of phase or input voltage.

2. Power control shall maintain proper dimming performance for all line feed frequencies from 47-53Hz and 57-63Hz without flicker or misfire. Shifts in frequencies up to 3 Hz shall not result in flicker or loss of dimming timing. Systems must perform to these frequency tolerances and shifts.

3. Dimmer output levels shall be regulated for incoming line voltages. The regulation shall adjust for both RMS voltage changes and deformations in the incoming AC waveform. The power control shall monitor and adjust each dimmer's output to maintain a constant power to the load. Regulation shall maintain the desired output voltage ±1V for the entire operating range (91-139V and 181-259 VACS) with the exception that the maximum output will be no

greater than the line voltage minus dimmer insulation loss. The regulation shall compensate for dips and anomalies in the AC waveform on a dimmer by dimmer basis. There shall be no interaction between dimmers in the system or any other equipment. The output shall be nominally regulated to 115V/230V appropriate for the market, but shall be field adjustable on a dimmer by dimmer basis to allow for varying cable length. Systems must maintain performance to the above stated voltage regulation.

4. Power control shall support a rack filled with different types and sizes of dimmer modules. The properties of each dimmer shall be configurable, including dimmer name, output curve, dimmer firing mode, and scale voltage values.

    a) The output curve selections shall include IES Modified Square, Square, Linear, Modified Linear and a Sensor v2.0 output curve. The power control shall also have the capability of storing up to three custom curves as well as an adjustable preheat level, assignable on a per-dimmer basis.

    b) The dimmer firing modes shall include: Normal (Dimmed), Dimmer Doubled, Switched (unregulated on/off with adjustable on-at level), Fluorescent with adjustable threshold, and Off.

    c) Dimmers set as Dimmer Doubled shall allow a single dimmer to set two different levels on one dimmer circuit by splitting the AC power into positive and negative half cycles with no resultant DC line current.

    d) Power Control must support all above listed adjustments to dimmers on a per circuit basis.

5. Controller shall support two (2) methods of automatic configuration during controller replacement in a rack.

    a) Use backplane configuration- The backplane shall retain full setup and preset data in. In this recovery mode, when a new power control is inserted, the controller shall automatically come on-line fully functional without any manual intervention.

    b) Use controller configuration- Override backplane configuration such that replacement modules automatically use the configuration resident in nonvolatile memory of the power control.

6. Controller shall be capable of changing rack setup for multiple shows for an entire system with a single update command from a remote PC. Show setup shall be saved in XML format and capable of being saved/uploaded from both USB and remote PC.

7. In the event of data loss each rack shall maintain the last level for a user programmable time of zero to five minutes or indefinitely, or may be programmed to fade out or to play a specific preset. Systems must offer this feature.

8. The power control shall contain diagnostic routines to allow the user to test and troubleshoot the system. The power control shall also contain a Test/Bypass switch to turn all dimmers on to full for testing. This switch shall bypass all electronics and shall force the fan on. Systems must include local control, “all on” control bypass, and diagnostic routines.

9. The power control shall be able to record up to 64 presets in a rack. Presets shall be user programmable by recording a snapshot of current dimmer levels (as set by the all control sources), by entering dimmer levels on the power control directly, or a combination of both methods. The system shall have the ability to program and activate group wide presets from the power control, remote station, console, networked computer, or handheld device. Presets shall be activated in the default fade time of 2 seconds, but shall be have a user-programmable fade time between 0 and 60 minutes.

10. DMX A and B as well as the Ethernet DMX (EDMX) data may be patched using a rack start address - assigned sequentially from a starting control channel or patched individually on a per-dimmer basis. Priority may be set per universe for the DMX inputs, and set per universe by the control source for Ethernet input. Each dimmer may have up to six network control inputs with either a highest takes precedence or priority patch. Each dimmer may also then be assigned to one of 16 spaces for additional specific preset control. Each preset shall have a separate priority for maximum flexibility of prioritization. Systems that must support prioritization of multiple Ethernet sources beyond HTP shall not be deemed acceptable. Systems must support the above listed flexibility in control source prioritization shall not be deemed acceptable.

11. Power control shall provide the ability to set a single circuit, all circuits or a range of circuits to a level at the control interface in the rack. Systems that cannot locally control dimmers through local control override shall not be acceptable.

12. The power control shall be capable of monitoring and displaying incoming line voltage for all three phases on the LCD. With installed current sensors, the same display shall show amperage on each phase.

13. The power control shall support security protected access. The user shall to able to program passwords that restrict access, preventing unauthorized use of higher-level functions by unauthorized personnel. Systems that do not provide security protected access to features that can render the system unusable shall not be acceptable.

E. Standard Feedback:

1. System and Rack messages shall include, but not be limited to, the following:

    a) DMX port A or B has an error or has failed

    b) Network has an error or has failed

c) Phase A, B or C is below 90 volts

d) Phase A, B or C is above 140 volts

e) Phase A, B or C did not start because it was below 90V or above 140V at power up

f) Phase A, B or C voltage headroom warning

g) Frequency is not 50 or 60 Hz

h) Rack shutting down due to air flow loss

i) Ambient temperature is below 0°C/32°F

j) Ambient temperature is above 40°C/104°F

k) Rack shutting down - ambient temperature exceeds 46°C/115°F

l) Configuration memory error

2. About display shall allow monitoring of system, rack or dimmer status.

a) About System shall provide information about Panic circuits, Preset looks, and System name.

b) About Network shall provide IP address, gateway and net mask.

c) About Rack shall provide information about rack name, ambient temperature, air filters and rack type.

d) About Rack Power shall provide information about power type, rack voltages, current per phase (only with current transformers), under voltage warnings.

e) About Rack Data shall provide status for DMXA, DMXB, EDMX and Network activity.

f) About Dimmer shall provide information about dimmer type, location, output level, control source, scale voltage, mode and curve.

F. Advanced Feedback:

1. Sensor's Advanced Features (AF) option shall add an additional sensor in the individual dimmer modules. This option shall allow monitoring of current and output voltage on a dimmer by dimmer basis and provide information on lamp burnouts, dimmer status, and input voltages.

2. Power control shall allow the user to record the loads of all AF dimmers in the system. The power control shall, during operation, test each AF dimmer, determine its load, and compare it to the recorded load. Any change from

recorded loads of configured tolerance shall display an error on the power control and any monitoring device on the network. If a dimmer is driven on with no load, an optional message shall be available to notify the console operator and electrician that there is no load.

3. Dimmer Specific messages shall include, but not be limited to, the following:

    a) Load has dropped below recorded value

    b) Load has raised above recorded value

    c) DC detected on dimmer output

    d) One SCR has failed on/off

    e) Dimmer has failed off or circuit breaker has tripped

    f) Dimmer has been removed

    g) Dimmer load has failed

    h) Dimmer has shut down due to over temperature

4. About Dimmer display shall provide additional information regarding the dimmer's recorded load and current or actual load.

G. Network Interface:

1. The Ethernet network shall provide an integral link to connect all racks in the system for rack-to-console and rack-to-network device communication.

2. The network interface to the power controller shall provide a number of user-programmable control schemes between control sources, including architectural control.

3. Hardware settings for rack type, available module types, availability of AF features, and operating voltage shall be configurable at the factory or in the field, and shall not require secondary setup after system commissioning even in the event to power controller replacement.

4. User programmable parameters shall support onsite setup, via the local interface in the rack. These parameters shall include, but not be limited to, defining module type, scale voltage for each dimmer, firing mode, curve, dimmer numbering and DMX512 or network port assignments. Systems requiring factory programming shall not be acceptable.

H. Provide one (1) CEM3 control module (7140A1001) with Smartlink and one (1) spare CEM3 control module.

IV. CONTROL PROCESSOR MODULES

A. The Architectural Control Processor shall be the Unison Smartlink S-ACP Series Control Processor as manufactured by Electronic Theatre Controls, Inc., or equal.

B. The Architectural Control Processor (ACP) assembly shall be designed for use in DRd Series Dimming Enclosures.

C. The processor shall utilize microprocessor based, solid state technology to provide multi-scene lighting control.

1. ACP shall support functions such as system programming. ACP station shall allow configuration of the control system via the menus.

2. When used in a dimming enclosure, the ACP shall allow access to dimming control menus including the status screen, dimming configuration screen, backup menu, test menu and configuration menu.

D. One ACP shall be rated to drive up to 48 channels of control, 64 presets, and 16 button stations.

E. ACP module electronics shall be convection cooled.

F. The ACP shall provide front-panel Secure Digital (SD) card slot for configuration and data exchange.

G. Architectural Lighting System configuration and program information shall be stored in flash memory, which does not require battery backup.

H. The ACP shall be contained in a plug-in assembly and require no discrete wiring connections; all wiring shall be terminated into the Rack Enclosure.

1. The ACP shall support the following communications:

a) Echelon LinkPower

b) ESTA DMX512A

I. Provide one (1) Smartlink Architectural Control Processor and one (1) spare S- ACP

V. DIMMER MODULES

A. The dimmer modules shall be the Sensor dimmer modules as manufactured by Electronic Theatre Controls, Inc., or equal. Sensor modules shall be designed for complete flexibility of choice for dimmed, non-dim, or hot power on each 20A branch circuit. A single module shall provide one of the following:

1. Two dimmed outputs with choice of 500 or 350us rise times, controlled by DMX.

2. Two air gap relay switched outputs controlled by DMX.

3. Two manual bypass constant power circuits, controlled manually.

a) The module may be configured to operate as two dimmers, two relays, or any combination of relay and dimmer from the CEM3 Power Control module or from an ETC control console connected to a CEM3 system. Any single circuit may be set to bypass the dimmer using a switch on the front of the module.

4. The power control system shall report circuit specific errors via the rack control electronics and/or via a lighting control console.

5. Modules shall provide the following status reporting functions:

a) Load dropped below recorded value

b) Load increased over recorded value

c) DC on dimmer output

d) SCR failed on/off

e) Circuit breaker tripped

f) Dimmer error

g) Module removed

h) Load absent

B. Electrical:

1. Each dimmer module shall contain two single-pole circuit breakers, a solid-state switching module, associated toroidal filters, and power and control connectors, a 120VAC remotely controllable mechanically latching air gap relay, a low voltage dc manual bypass override switch, and one fuse per branch circuit for sufficient short circuit rating.

2. Modules shall not have any protruding pins subject to physical damage when the module is not installed.

3. Modules shall be keyed so that dimmer modules of different capacity shall not be interchangeable.

4. Each dimmer shall be protected by a fully magnetic single pole, 20 amp, or as shown on the Drawings, one hundred percent (100%) rated circuit breaker listed at 10,000 amps or greater interruptible current mounted on the face plate of the dimmer. The breaker shall be used as a dimmer disconnect and shall be rated for 100% switching duty. Circuit breakers shall be rated for tungsten loads having an inrush rating of no less than 20 times normal current. Under overload conditions, the circuit breaker shall disconnect power to the dimmer module before damage can be done to the power devices. The trip current shall not be affected by ambient temperature within the operational specifications of the system. Dimmers must operate continuously at 100% load.

5. Modules that use Triac dimming shall not be acceptable. Modules which utilize an SCR or Triac solid state switch as a dimmer bypass may void warranty of products they are powering and shall not be an acceptable means of bypass.

C. SCR Assembly:

1. Each dimmer shall be rated 2.4kW.

2. Each dimmer module shall use a solid-state module (SSM) consisting of two silicon-controlled rectifiers (SCRs) in an inverse parallel configuration, and all required gating circuitry on the high voltage side of an integral, opto-coupled control voltage isolator. Rectifiers, copper leads and a ceramic substrate shall be reflow soldered to an integral heat sink for maximum heat dissipation. The SSM shall also contain a control LED, a thermistor for temperature sensing, and silver-plated control and load contacts. The entire SSM shall be sealed in a plastic housing requiring only a screwdriver to replace. Dimmers must employ triac power devices, pulse transformers, or other isolating devices providing at least 2,500V RMS isolation. Dimmer modules requiring disassembly, heat sink grease or additional tools for repair shall not be acceptable.

3. All electronic components (current/voltage sensors and indicators) shall be contained in a single, field-replaceable housing. Modules requiring discrete wiring of electronic components shall not be acceptable.

4. SCR power switching devices shall have the following minimum ratings:

Module Size:	20A
Single cycle: Peak surge current	625A
Half cycle: 12T	1,620
Transient over voltage	600V
Die size (in.)	.257

D. Filtering:

1. Dimmer modules shall include toroidal filters to reduce the rate of current rise time resulting from switching the SCRs. The filter shall limit objectionable harmonics, reduce lamp filament sing and limit radio frequency interference on line and load conductors. Modules shall offer 350 or 500 uS, filter rise times. Rise time shall be measured at the worst case slew rate (about 50 percent) from 10 to 90 percent of the output wave form with the dimmer operating at full load.

2. All dimmers shall maintain their published rise time and/or fall time regardless of duty cycle or rack temperatures. Dimmers that derate due to increased dimmer

temperature caused by full load operation or high phase angles shall not be acceptable.

E. Power efficiency for standard dimmers shall be at least 97 percent at full load with a no-load loss of 3V RMS. The dimmer shall accept hot patching of a cold incandescent load up to the full rated capacity of the dimmer.

F. Dimmer modules shall be fully plug-in and factory wired. Dimmer modules shall consist of a heavy duty, die-cast aluminum chassis with integral face panel. No tools shall be required for module removal and insertion. All parts shall be properly treated, primed and finished in fine-texture, scratch resistant, gray epoxy powder coat. With the exception of the circuit breaker, the module shall contain no moving parts. Each module shall be labeled with the manufacturer's name, catalog number and rating. Modules constructed of molded plastic for structural support are not equivalent and are not acceptable. Dimmer modules shall be UL Recognized.

G. Provide twelve (12) D20AFTR Advanced Features Thru Power Dimmer Modules. Manufacturers that do not have a Thru Power Module will provide twelve (12) 500MS Rise Time Dimmer Modules and twelve (12) Relay Modules.

VI. DMX/RDM REPEATER (OPTO SPLITTER)

A. The DMX/RDM Installation Repeater shall permit star-wiring of DMX512 signals and shall isolate DMX transmitters and DMX receivers from common mode voltages, ground loop currents and other electrical faults.

1. The DMX/RDM Installation Repeater shall have bi-directional ports to allow Remote Device Management (RDM) data packets to be sent and received between control systems and responding devices.

2. Each DMX/RDM Installation Repeater shall have one input port and eight output ports. No in-line processing of the input signal is permitted to ensure the highest reliability.

3. DMX signal splitting shall be provided using 4-output DIN-rail mounted modules for easy expansion and/or servicing.

4. The system shall be capable of repeating simplex protocols other than DMX512, provided they meet the electrical requirements of EIA-RS422 or RS485.

B. Physical:

1. Enclosures shall be surface-mount NEMA 1 enclosure types, and shall be constructed from 18-gauge steel, finished in satin black powder epoxy, with a non-louvered, surface cover.

2. Dimensions shall be 10.25” x 23.25” x 4.5” (260mm x 510mm x 120mm) for the eight output units.

3. Enclosures shall be provided with ½” and ¾” conduit knockouts, appropriate

internal voltage barriers, and shall be clearly labeled as “Pathway eDIN System”.

C. Electrical:

1. The power supply shall be a field-replaceable, wide-range input (115/240VAC, 50/60 Hz), UL-listed switching power supply. There shall be no power switch to reduce the chance of accidental shut-off.

2. There shall be 2500-volt electrical isolation between all input and output sections, and between adjacent output sections.

3. The input and each output shall be capable of withstanding the continuous application of up to 250V without damage to internal components. Input and output protection shall be of the self-resetting type, rated for 250V. Replaceable fuses are not acceptable.

D. Field Connections:

1. All internal field wiring connections shall be clearly labeled according to their function.

2. Connections for all data input, output and pass-thru ports, and DC power shall be two-part, Phoenix-type screw terminal strips, capable of accepting #26 to #14 gauge solid or stranded wire.

3. An active, isolated data pass-thru connection port shall be provided to allow daisy-chaining of additional modules or Installation Repeaters.

4. The power supply connections shall be capable of accepting up to #12 gauge solid or stranded wire. A suitable terminal shall be provided for ground wire connection.

E. Features:

1. Each repeater module shall incorporate LED indicators for DC power input, isolated DC power, DMX input and processor status.

2. Each module shall have two LEDs per output port to indicate active DMX output and RDM activity for that port.

3. Each module shall be individually discoverable via RDM. No remote configuration options shall be available to the user.

4. Each DMX/RDM port shall incorporate an active data line terminator.

F. Compliance:

1. The DMX/RDM Installation Repeater shall be compliant with ANSI E1.11 DMX512-A (2004), USITT DMX512 (1990) and ANSI E1.20 Remote Device Management (2006).

2. The DMX/RDM Installation Repeater shall be ETL-listed.

3. The DMX/RDM Installation Repeater shall be compliant with the RoHS 2002/95/EC directive.

G. Provide a wall mounted Pathway 8-way DMX/RDM Installation Repeater, or approved equal.

VII. DATA PLUG-IN STATIONS

A. Data Plug-in Stations shall consist of the appropriate connectors required for the functional intent of the system. These stations shall be available with DMX input or output, Remote Focus Unit, Network, or architectural control connectors as shown on the Drawings or as required.

B. Connector Options:

1. The following standard components shall be available for Plug-in Stations:

a) 5-Pin male XLR connectors for DMX input

b) 5-Pin female XLR connectors for DMX output

c) RJ45 connectors for Network connections - Twisted Pair

C. Physical:

1. Station faceplates shall be .80” aluminum, finished in fine texture, scratch-resistant black powder coat. Silk-screened graphics shall be white.

2. The station panel shall mount into an industry standard back box, depending on size and quantity of connectors. A terminal block shall be supplied for contractor terminations.

D. Provide the following Data Plug-In Stations:

1. One (1) ECPB NET

2. One (1) ECPB DMX

VIII. PRESET STATIONS

A. The Button Station shall be the Smart Link Button Station as manufactured by Electronic Theatre Controls, Inc., or equal. It shall be a remote station on an Echelon LinkPower network that can play presets stored in a host product such as a SmartPack dimmer pack, SmartSwitch Relay panel or in the Control Electronics Module (CEM+) of a Sensor+ dimmer rack. The station shall consist of a dual function (program/play) push-button with an integral LED for each corresponding look.

1. Standard stations shall control five (5) backup looks.

2. The system shall support up to four stations without an additional power supply.

B. Electrical

1. Button station wiring shall be an Echelon® Link power network. Link power shall utilize low-voltage Class II unshielded twisted pair, type Belden 8471 or equivalent, and one #14 ESD drain wire (when not installed in grounded metal conduit).

2. The station shall operate on ± 21 VDC provided by the CEM+ via the Link power network (for more than 4 stations, an additional power supply shall be required). The number of stations shall be limited by the available power.

3. Station wiring must be topology free. It may be point-to-point, bus, loop, home run or any combination of these.

4. Network insulation displacement connectors shall be provided with all stations.

C. Station Addressing

1. Preset addressing for stations shall be via a 7- position dipswitch, and will be set by installers or factory personnel. Stations shall address only consecutive presets. Multiple stations of the same type and address are permissible. Multiple stations with different button quantities may have “overlapping” preset addresses.

2. Stations shall not address presets in different rooms

D. Play Presets

1. Pressing a button shall play the corresponding preset. The station will send the command to play the look to all host products. If the look is a recorded look, the button's LED will stay lit. If the look is unrecorded, the LED will go off.

2. The station shall monitor (at 30-second intervals) the status of presets. If any looks are active in the range of the station's numbered push-buttons, the station shall light the corresponding LED regardless of which device (console, host product, network PC or Button station) activated the look.

3. If the button with the active look (LED lit) is pressed, the station shall send the command to return to normal operation, deactivate the preset and turn off the LED.

4. Only one preset may be active at a time. Pressing a second button shall play the corresponding preset and fade out any preset previously active.

E. Physical

1. Control station electronics shall mount directly behind the faceplate. A terminal block shall be supplied for contractor terminations. The entire assembly shall

mount into a single gang back box. Back boxes for the flush mounted stations shall be industry standard back boxes. The manufacturer shall supply back boxes for surface mounted stations.

2. Station faceplates shall be constructed of ABS plastic and shall use no visible means of attachment. All Button stations shall be available with white, signal white, ivory, gray or black faceplates and buttons.

F. Provide one (1) SH 10005 SmartLink button station.

IX. LIGHTING CONSOLE AND ACCESSORIES

A. The lighting control console shall be a microprocessor-based system specifically designed to provide complete control of stage, studio, and entertainment lighting systems. The console shall be the “Element” as manufactured by Electronic Theatre Controls, Inc., or equal.

1. The control system shall be Net3 and Net2 native, with both protocols output simultaneously over the network. The system shall also be able to control third party ACN devices directly. The system shall provide control of 1024 outputs on 250 channels.

2. A maximum of 10,000 cues, 1000 groups, 1000 Intensity Palettes, 1000 Color Palettes, 1000 Focus Palettes, 1000 Beam Palettes, 1000 effects, 1000 macros and 100 curves may be contained in non-volatile electronic memory and stored to an onboard hard disk or to any USB storage device.

3. The console may be placed in Tracking or Cue Only mode by the user as a system default and overridden on individual record actions as required.

4. A Master Playback fader pair and dedicated Grand Master/Blackout shall be provided.

5. The console shall provide 40 pageable faders and bump keys that may be operated in either LTP channel or HTP/LTP submaster mode. The console shall support a total of 300 submasters.

6. A high-resolution level wheel shall be provided to control intensity for selected channels and scrolling within selected displays. On demand moving light controls shall be provided for control of other non-intensity parameters. Non-intensity parameters shall be controllable via the on demand or keypad controls.

7. On demand moving light controls shall provide mouse-based tools for non-intensity parameters. The tools shall display the current value for each parameter and shall provide controls for adjusting each parameter.

8. Control and programming features for automated fixtures shall also include: a standard library of fixture profiles, the ability to copy and edit existing profiles and create new profiles, patch displays including channel and output addressing, 16-bit fade resolution, color characterization allowing color mixing

and storing in Hue and Saturation or native device values.

9. System information, including playback status, live output and blind values for all record targets shall be displayed on a maximum of two external high resolution DVI monitors, or one SVGA monitor, which may also be touch-screen(s). Only one display shall be required for operation.

10. The system shall direct user input through on-screen dynamic prompts and integral LEDs on console keys indicating current operating mode. A context sensitive on-line Help feature shall explain and provide an example of the operation of each feature of the system.

11. An optional, fully-functioning, detachable alphanumeric keyboard shall be supported. The keyboard shall allow labeling of channels, cues, presets, groups, palettes, effects, macros, curves and the show. An integral electronic keyboard shall be provided.

12. A row of softkeys shall be provided, which change function based on the selection and context of the console. These softkeys shall be labeled on the connected external display.

13. Console software upgrades shall be made by the user via a USB port; changing internal components shall not be required.

14. The console operating software shall be loaded into program execution memory from the internal hard drive when the console is powered. In the event of an uncontrolled shutdown, the console shall return to its last output state when power is restored.

15. Show data may be created and modified on a personal computer, using either Windows XP or Windows 7 operating systems, using a free offline editing application. The offline editor may also run natively on Macintosh platforms using OS X.

16. A PC, using Windows XP, Windows 7, or a Macintosh computer running OS X, running a client software application shall be able to connect to a control system via the network and view current show data in a mirrored display environment.

17. The system shall allow remote control from a purpose-built wireless remote focus unit (Radio Focus Remote). Systems without these remote-control devices shall not be acceptable.

18. The system shall support a Telephone remote control that allows basic functions to be controlled from a standard wireless phone producing touch-tone signals. This allows the use of a standard telephone for a low cost remote control. Systems that do not allow this function shall not be acceptable.

19. Network management tools shall be provided from the desk itself.

20. The system shall support up to 32 individual Time Code Event lists.

B. Controls and PlaybackManual Control and Programming Section

1. General

a) The console keyboard shall be grouped by function. Major groupings shall be record target functions, numeric keys, level assignment functions, display navigation functions and controls.

b) Non-intensity parameters may be set numerically or via the on demand moving light controls. This control shall be fully interactive. In either case the current parameter value shall be displayed on the console monitor.

c) Only those parameters available for control in the active lighting system shall be displayed for control.

d) Lamp controls provide direct access to luminaire functions such as striking and dousing arc lamps and calibrating entire fixtures or individual mechanisms of fixtures, as provided by the luminaire manufacturer. User access to these features is normalized across all manufacturers for ease of use. Use of a “control channel” for accessing these functions shall not be required and systems requiring use of a control channel shall not be acceptable.

e) Fixtures with CMY or RBG color mixing may be set with direct CMY or RBG controls, as well as the Hue and Saturation controls and/or color picker. Color may also be set directly to a gel match, normalized to 3200K.

2. Playback Section

a) The master fader shall consist of a 60mm Master Fader pair with associated Load, Go and Stop/Back buttons.

b) It shall be possible to instantaneously halt an active cue, go back to the previous cue, manually override the intensity fade or manually override the entire fade.

3. Integral Channel/Submaster Faders

a) Submaster and fader support shall be provided via 40 or 60 integral 45mm faders with bump leys. These faders shall be pageable and shall operate in LTP channel and LTP/HTP submaster modes.

b) LTP channel mode shall allow the user access to intensity of the first 120 channels and shall operate with LTP logic. Faders that are not currently set to the same level as the corresponding channel shall have to be matched to that level before affecting said channel.

c) Up to 240 proportional, fully overlapping additive or inhibitive

submasters may be defined. Submasters shall have colored LEDs to indicate submaster status. Each submaster may have fade up, dwell and down fade times. Each has a bump and assert/channel select button. Submasters may be set to independent, exclusive and proportional/intensity master control.

d) The submaster blind buffer shall be linked directly to live playback allowing live editing of live submaster content via the command line.

e) It shall be possible to set submaster values directly from the command line.

4. Grand Master

a) A dedicated 60mm grand master and blackout button are provided.

b) The grand master shall proportionally fade intensity values to zero. Blackout shall send all intensity outputs to zero. Non- intensity outputs shall not be affected. No additional configuration shall be required to withhold non-intensity values from Grand Master and Blackout control.

C. Display ControlsFormat shall change the view of selected displays.

1. Channel views may be displayed either in an expanded table view combining conventional channel symbols with table views for multi- parameter devices, or in a channel summary view.

2. Flexi channel shall change which channels are viewed in selected displays, based on a variety of different criteria, including all channels, patched channels, active/move channels, manual channels, selected channels and user-specified channel lists.

3. Expand shall extend the selected view sequentially across connected displays.

D. Data shall display absolute values of referenced data.

1. Operating ModesLive Mode

a) Channel lists may be constructed using the +, - and Thru keys.

b) Levels may be set with the keypad, level wheel and on demand moving light controls. “Selected” channels shall be those last addressed and under keypad control.

c) Sneak shall be used to restore specified channels to background states, default values, or to send them to specified values, in user specified or default times.

d) Selected channels may be set at a level or held to current values while all other channels are set to zero using Rem Dim. Toggling Rem Dim shall restore all unselected channels to original levels. The Rem Dim

level shall be user definable.

e) Channels may be recorded into groups for fast recall of commonly used channels. 1000 groups shall be available. Groups shall store selection order. The Offset function supports rapid creation of ordered groups, including reverse and random order.

f) Parameter settings may be stored to Focus and Color Palettes. All referenced data may be stored to whole numbers or to up to 99 decimal places between each whole number. It shall be possible to store 1000 of each palette type.

g) Any collection of channel data, as determined by the use of “Record” or selective store commands may be stored to palettes (as appropriate to the type).

h) The following conditions may be placed on a channel or channel parameter to be included with a cue record action.

    (1) Block flag

    (2) Note

i) Cues may be recorded in any order. Up to 99 decimal cues may be inserted between any two whole number cues. Each cue may contain a maximum of twenty parts. Parameters may be automatically assigned to specific parts or assigned when the part is created.

j) It shall be possible to record cues and cue parts with the following information:

    (1) Any collection of channel data, as determined by the use of “Record” or selective store commands.

    (2) Cue Level timing and delays for Intensity Up and Intensity Down, Parameter moves shall follow the Intensity Up time.

    (3) Follow or hang time

    (4) Link instruction

    (5) Loop value

    (6) Block and/or preheat

    (7) Curve

    (8) Label and note

    (9) Execute list to trigger other activity

k) Non-intensity channel parameters may be marked (preset using Automark. Automark presets any parameter transitions in the cue just prior to intensity becoming active. Automark may be disabled on a cue or cue part basis, enabling a “live” move.

l) Any channel parameter may be stored with an effect instruction. These effects may contain relative offsets from current value, or absolute instructions. Effects may be progressive action or on/off states. Entry and exit behaviors shall modify the channel parameters activity when beginning and ending the effect.

m) Update may be used to selectively add modified parameter data quickly to that parameter’s current source. It shall be possible to update inactive record targets. It shall also be possible to update back to the current source of the move instruction without specifying that cue via Trace.

n) Recall From quickly pulls specified data from record targets into the current view.

o) Copy To quickly copies selected data to specified record targets.

p) Address and channel check functions shall be provided.

q) Channel parameters may be “parked” at levels. Output addresses may also be parted directly. Parked levels shall not be added to any live record operations, nor may they be changed until the parked element is “unparked”. Address park shall also be provided.

r) About shall provide detailed status of selected channels or specified record targets, including utilization information. About shall also access lamp control functions to calibrate devices, strike and douse arc sources. Use of a luminaire control channel for these functions shall not be acceptable.

s) Live data may be displayed in an expanded table view containing conventional symbols and table views for multi-parameter devices or in a summary view.

t) Undo shall be used to sequentially step back through manual operations, record, update and delete actions. Redo functions shall be provided. Multiple undo commands may be executed at once.

u) Home shall set selected channels non-intensity parameters to their default values.

v) Move shall allow all show data to be moved from one record target to another.

2. Blind

a) The Blind display allows viewing and modification of all record targets without affecting stage levels.

b) Record target data may be displayed in an expanded table view containing conventional symbols and table views for multi- parameter devices, in a summary view or a spreadsheet view, which allows quick data comparisons, move and replace with functions.

c) Changes made in blind displays shall be stored automatically.

d) Blind editing shall be possible for all record targets.

e) It shall be possible to show or hide parameter data in spreadsheet views for simplicity in viewing/editing.

3. Patch Display

a) Patch shall be used to display and modify the system control channels with their associated library data.

b) Each channel may be provided with a proportional patch level, preheat, curve, label, swap and invert functions.

c) Offset functions in patch shall allow selection of channel ranges and shall allow the user to establish a “custom” footprint for any device output.

d) Custom color wheels, color scrolls and gobo wheels shall be defined in patch. These devices shall be created with a simple table and graphical user interface supported by images of major manufacturers.

e) Copy to and Move functions shall be supported in patch.

4. Setup/Browser

a) Setup shall access system, show and desk configurations.

b) The browser shall access show data storage, import, export, print to .pdf and clear functions, as well as show data utilities.

E. Interface Options: The console shall support a variety of local interfaces.

a) AC input.

b) USB (a minimum of five ports shall be provided for connecting devices such as an Alphanumeric keyboard, mouse, touch screens, USB Flash drive, etc.) The desk shall provide at least four ports on the rear of the console and one on the control surface itself.

c) Ethernet (one port) 802.3af compliant.

d) Two DVI video output connectors, supporting a maximum of two DVI monitors at 1280x1024 resolution minimum.

e) One VGA output connector.

F. Accessories Required

1. iRFR an iRFR Preview (applications for iPhone, iPod Touch and iPad)

2. aRFR (application for Android devices)

3. Element Client Software Kit

4. One (1) 19” ELO LCD Touchscreen Monitor

G. Physical

1. All operator controls and console electronics for a standard system shall be housed in a single desktop console, not to exceed 32.9” wide, 17.9” deep, 5.1” high, weighing 30 pounds.

2. Console power shall be 95 – 240V AC at 50 or 60Hz, supplied via a detachable power cord.

H. Provide One (1) Element 40, 250 control channels (4330A1030).

X. ELECTRICAL DISTRIBUTION EQUIPMENT

A. All distribution equipment shall be furnished by the manufacturer of the dimming equipment. Hanging and supporting hardware shall be furnished and installed under Division 11 or Division 5 Contractor.

B. Plug-in Outlet Boxes shall be furnished and installed where shown on the Drawings.

1. Plug-in outlet boxes shall be complete with three-pole, 20A grounded stage pin connector type female receptacles attached to twenty four (24) inch pigtails.

2. Pigtails shall be three-wire type “SOW” rubber jacketed cable sized for the maximum circuit ampacity.

3. Pigtails with 20-amp stage pin connectors shall be terminated using 12 gauge 4-way indent crimp (with inspection window) type where the wire is inserted and crimped directly in the socket.

4. Terminations for pigtail connectors shall utilize feed-through terminals individually labeled with corresponding circuit numbers. 20 amp circuits shall use screwless tension clamp terminals listed for 20 – 8-gauge wire. Terminals that place a screw directly on the wire are not acceptable.

5. Pigtail outlet boxes shall be supplied with appropriate brackets and hardware for mounting as shown on the Drawings.

a) Standard mounting options shall include pipe or wall mounting.

b) Brackets shall be made from ASTM A 36 steel.

c) Hardware shall be ASTM A307 grade 5.

6. A low voltage distribution system shall be available to incorporate DMX, Ethernet or other protocols as specified in the plug-in outlet box where shown on the Drawings.

a) A voltage barrier shall be used to separate the low voltage wiring for the electrical circuits.

7. Physical:

a) Plug-in outlet boxes shall be 6.25” H x 3.3” D and fabricated from 18-gauge galvanized steel and finished in black fine-texture powder coat paint.

b) Covers shall be fabricated from 16-gauge galvanized steel.

c) Plug-in outlet boxes shall be available in any length specified in increments of 3-inches with a maximum length of up to 3-feet.

d) Pigtails and outlets shall be spaced on 4” centers, or as otherwise specified.

e) Pigtail outlets shall be mounted on individual 3” panels.

f) Circuits shall be labeled with 1.25” lettering. Circuit labeling shall be located on the front side of the plug-in outbox with white lettering on black background.

g) Pigtail boxes shall support and include optional LED indicators to indicate the presence of power at each local circuit. The LED indicator shall be red in color and mounted in the cover plate directly below the circuit label for pigtail circuits.

8. Plug-in outlet boxes power distribution equipment shall be Underwriter Laboratories (UL) LISTED. Plug-in pigtail outlet boxes shall be the Electronic Theatre Controls, Inc. 9300 Series or equal (for surface or pipe mounting).

C. Pipe Batten

1. The pipe batten shall be 1½” schedule 40 grade A, seamless pipe fabricated in the largest possible lengths without splices. Battens of greater length shall be spliced by means of .120 x 1 9/16 dia. DOM tube 18” long with 9” of tube inserted into each half of the splice. The tight-fitting splice tube shall be held in place by a pair of 3/8 x 2 ½” grade 5 hex bolts on each side of the joint. The bolts shall pass through the pipe at an angle of 90° to each other. There shall

be two bolts on each side of the joint spaced 1" and 8" from the joint. Alternatively, one pair of bolts on one side of the joint may be replaced with either plug welds or tight fitting steel rivets. Pipes shall be straight and painted flat black.

2. Grids shall be installed as indicated on the drawings with pipes intersecting on four foot by four foot centers.

3. Intersecting pipes shall be joined with SSRC # 1202-15 Grid Connector or by an approved equal.

4. The grid shall be nominally rated for 30 pounds per linear foot of pipe.

5. A safety-yellow batten cap shall be installed at each end of each pipe batten.

6. The manufacturer shall provide four self-adhesive labels for each batten on which the rated batten load shall be written by the installer.

7. Chain used for dead hung suspension shall be zinc plated NACM, Grade 30 proof coil chain with ¼" shackle and 1 ½" Grad 5 safety bolt. Top and bottom attachment shall be made via a wrap and a half of chain with shackle and safety bolt. Hardware shall be US made and be stamped with safe working load.

8. Bottom attachment with rated Crosby shackle to the connector strip hangar bracket will be acceptable for all electrics with connector strips.

XI. THEATRICAL LIGHTING INSTRUMENT PACKAGE

A. Theatrical lighting instruments manufactured by Electronic Theatre Controls, Inc. (ETC) are specified herein to provide a basis of quality. Other acceptable manufacturers are DESISTI and STRAND LIGHTING, INC.

B. Theatrical lighting instruments shall be capable of performing with tungsten halogen lamps and light emitting diodes (LED) as indicated herein with proper heat sink cooling. Phenolic materials shall be employed on the fixtures in order to protect the operator from potential burns.

C. Each theatrical lighting instrument shall be supplied with a malleable iron clamp to grip up to a two (2) inch ID pipe, a fixture yoke with locking clutch handle, and three (3) foot long SF2 leads in a fiberglass sleeve.

D. Minimum performance criterion for all theatrical lighting instruments shall be as herein specified. Each instrument shall be furnished with a three pole, grounded stage-pin male connector and safety cable. UL listing shall be required on all theatrical lighting instruments.

E. Ellipsoidal Reflector Spotlights (ERS):

1. The unit shall be constructed of rugged, die cast aluminum, free of burrs and pits, finished in black, high temperature epoxy paint. Tools shall not be required for either lamp alignment or cleaning the reflector or lens.

2. The ellipsoidal spotlights shall include:

    a) Integral cable clamp for power leads.

    b) Positive locking of lamp focus and independent lamp alignment controls.

    c) High impact, thermally insulated knobs and shutter handles.

    d) Reflector secured with shock mounts.

    e) Lens secured with silicone shock mounts.

    f) 20-gauge stainless steel shutters.

    g) Insulated rear handle.

    h) Sturdy integral die cast gel frame holders with two accessory slots, and a top mounted, quick release gel frame retainer.

    i) Rugged 3/16” x 1-1/4” steel yoke with two mounting positions allowing 300°+ rotation of the fixture within the yoke.

    j) Positive locking, hand operated yoke clutch

    k) Slot with sliding cover for motorized pattern devices or optional iris.

3. The optical train shall combine a compact filament lamp with a precision molded borosilicate, ellipsoidal reflector and aspheric lens to produce an optimum cosine field. The unit shall provide, but not be limited to:

    a) Molded borosilicate reflector with multiple dichroic layers.

    b) 95% of visible light shall be reflected while 90% of infrared light as heat shall be transmitted through the reflector.

    c) Low gate and beam temperature.

    d) Sharp imaging through a three-plane shutter design.

    e) Projector-quality, high contrast aspheric lens, with an anti- reflective coating to increase transmission.

4. The unit shall be precision engineered to use an HPL lamp to deliver an even, intense field with cosine distribution. The unit shall provide, but not be limited to:

    a) 5, 10, 14, 19, 26, 36, 50, 70 and 90 degree field angles

    b) 25 – 50 degree Zoom range

c) High-quality pattern imaging.

d) Sharp shutter cuts without halation.

e) Shutter warping and burnout in normal use shall be unacceptable.

f) Adjustable hard and soft beam edges.

5. The unit shall be capable of utilizing ETC Dimmer Doubling technology.

6. The unit shall be UL and cUL listed and so labeled.

7. The high efficiency lamp shall be an HPL lamp, which shall consist of a compact tungsten filament contained in a krypton-filled quartz envelope. The lamp shall mount axially within the reflector. The lamp base shall have an integral die cast aluminum heat sink that reduces seal temperature and ensures proper lamp alignment. The lamp socket shall be ATP 220 nickel gold plated.

8. The Theatrical Lighting Instruments shall be ETC Source 4 Jr. Zoom ELLIPSOIDAL. This Contractor shall furnish the following types and quantities of ERS instruments with lamp, gel holder, C-clamp, and safety chain:

a) Eight (8) 25 – 50 degree zoom focus ERS's, ETC 42550J

F. Color Mixing Light Emitting Diode (LED) Wash Fixtures:

1. The lighting instruments (fixture) shall be a color-mixing high-intensity LED illuminator with DMX control of intensity and color. The fixtures shall be Desire D40 as manufactured by Electronics Theatre Controls, Inc. or approved equal.

2. The LED lighting instrument shall be UL 1573 listed for stage and studio use and shall comply with USITT DMX-512 A standard.

3. The LED lighting instrument shall be contained in a rugged all-metal die- cast housing, free of burrs and pits and shall have a black powder coat finish. Power supply, cooling and electronics shall be integral to each unit.

4. The LED lighting instrument shall have two (2) easy-access slots for secondary lenses and other accessories. The slots shall be equipped with locking retaining clips.

5. The LED lighting instrument shall include, but not be limited to:

a) Theatrical –style hanging yoke.

b) 25 deg. secondary lens.

c) Five (5) foot power lead with grounded stage-pin connector.

d) Yoke with floor stand conversion feature.

e) PowerCon to PowerCon cables for fixture power wiring.

f) Multiple secondary lens options to include multiple angles in the following patterns:

(1) Linear

(2) Round

(3) Oblong

6. Light output shall be via a round aperture. Aperture and accessory slots shall accommodate standard 7.5” accessories such as used in other similar-sized fixtures. Accessories available as options shall include but not be limited to:

a) Gel/diffusion frames

b) Top hats

c) Barndoors

d) Egg crate louvers

e) Concentric ring louvers

f) Multiple secondary lensing options

7. Thermal:

a) The fixture shall be totally convection cooled, requiring no cooling fan. Fixtures which require an on-board cooling fan shall not be acceptable unless pre-approved.

b) The fixture shall utilize advanced thermal management systems to maintain LED life to an average of 70% intensity after 50,000 hours of use.

(1) Thermal management shall include multiple temperature sensors within the housing to include:

c) LED array circuit board temperatures.

d) Temperature sensors placed on each individual LED color circuit.

e) Fixture ambient.

f) CPU.

(1) Fixture user shall permit monitoring of temperature sensors via a legible LCD multi-line backlit display.

(2) Fixtures that do not provide active thermal monitoring of LED circuits and other temperature readings shall not be acceptable.

g) The fixture shall operate in an ambient temperature range of - 20°C (-4°F) minimum, to 40° C (104°F) maximum ambient temperature.

8. Electrical:

a) The fixture shall be equipped with 100V to 240V 50/60 Hz internal power supply.

b) The fixture shall support power in and thru operation.

(1) Power in shall be via Neutrik® PowerCon™ input connector.

(2) Power thru shall be via Neutrik ® PowerCon ™ output connector.

(3) Fixture power wiring and accessory power cables shall be rated to support linking of multiple fixtures up to the capacity of a 15A breaker.

c) The fixture requires power from non-dim source.

d) Power supply outputs shall have self-resetting current limiting protection.

e) Power supply shall have power factor correction.

9. LED Emitters:

a) The fixture shall contain a minimum of 5 different LED colors to provide color characteristics as hereinafter described.

b) All LEDs used in the fixture shall be high brightness and proven quality from established and reputable LED manufacturers.

(1) Fixture shall utilize Luxeon® Rebel™ LED emitters.

c) Manufacturer of LED emitters shall utilize an advanced production LED binning process to maintain color consistency.

d) LED emitters should be rated for nominal 50,000 hour LED life to 70% intensity.

e) All LED fixtures (100% of each lot) shall undergo a minimum eight-hour burn-in test during manufacturing.

10. Calibration – Fixtures shall be calibrated at factory for achieve consistent color and intensity output between fixtures built at different times and/or from different LED lots or bins.

a) Calibration data shall be stored on the LED array as a permanent part of on-board operating system.

b) All arrays, including replacement arrays shall be calibrated to the same standard to insure consistency.

c) Fixtures not offering LED calibration shall not be acceptable.

11. Color – The fixture shall utilize a minimum of 40 LED emitters. The fixture shall be available in specialized LED arrays as outlined below:

    a) DESIRE D40

        (1) Red, Amber, Green, Cyan, Blue, Indigo and White LEDs in an array designed for broad spectrum color, light tints, and variable whites. This array shall be the Lustr+ array as manufactured by Electronic Theatre Controls, or approved equal.

    b) Measured brightness of the Lustr+ array shall be greater than 2900 field lumens

        (1) Red, Orange, Amber, Green, Cyan, Blue and Indigo LEDs in an array designed for broad spectrum deep colors. This array shall be the Vivid array as manufactured by Electronic Theatre Controls, or approved equal.

    c) Measured brightness of the Vivid array shall be greater than 2500 field lumens.

        (1) Red, Orange, Amber, Green and Indigo LEDs in an array designed for extra-high brightness output in red/warm end of the spectrum. This shall be the Fire array as manufactured by Electronic Theatre Controls, or approved equal.

    d) Measured brightness of the Fire array shall be greater than 2500 field lumens.

        (1) Red, Orange, Green, Cyan, Blue and Indigo LEDs in an array designed for extra-high brightness output in the blue/cool end of the spectrum. This shall be the Ice array as manufactured by Electronic Theatre Controls, or approved equal.

    e) Measured brightness of the Ice array shall be greater than 1800 field lumens.

12. Dimming:

    a) The LED system shall use 15-bit nonlinear scaling techniques for high-resolution dimming. At least four different dimming curve options

shall be accessible at the fixture's User Interface.

(1) Incandescent

(2) Standard

(3) Linear

(4) Quick

b) Dimming curves shall be optimized for smooth dimming over longer timed fades.

c) The LED system shall be digitally driven using high-speed pulse width modulation (PWM).

d) LED control shall be compatible with broadcast equipment in the following ways:

(1) PWM control of LED levels shall be imperceptible to video cameras and related equipment.

(2) PWM rates shall be adjustable by the user at the fixture if necessary to avoid any visible interference to video cameras and related equipment.

13. Control and User Interface:

a) The fixture shall be USITT DMX 512A-compatible via In and Thru 5-pin XLR connectors.

b) The fixture shall be compatible with the ANSI RDM E1.20 standard.

(1) All fixture functions shall accessible via RDM protocol for modification from suitably equipped control console.

(2) Temperature sensors within the luminaire shall be viewable in real time via RDM.

(3) Fixtures not offering RDM compatibility, feature set access or temperature monitoring via RDM shall not be compatible.

c) The fixture shall be equipped with multi-line LCD display for easy-to-read status reports and configuration changes.

d) The fixture shall be equipped with a six-button user-interface.

e) The fixture shall offer multiple DMX input profile options to include:

(1) RGB – control of all individual LED colors via a three- channel profile.

(2) Red, Green, Blue.

(3) HIS – control of all individual LED colors via a three- channel profile.

f) Hue, Saturation, and Intensity.

(1) HSIC – control of all LED colors via a four-channel profile.

g) Hue, Saturation, Intensity and Color Point.

h) Color point provides variable color temperature settings.

(1) Direct – control of each individual color channel via an independent channel.

(2) A variable-rate strobe channel shall be provided.

i) The fixture shall offer three output setting:

(1) Boost mode - powers LEDs at maximum intensity and provides no compensation against LED ‘droop’ or intensity loss.

(2) Regulated mode – slightly restricts maximum LED intensity levels to compensate against LED droop.

(3) Protected mode – further restricts maximum LED intensity levels to compensate against LED droop and offer color consistency at highest permissible ambient temperatures (40C).

(4) Fixtures that do not provide regulated and protected operation modes are not acceptable.

j) The fixture shall offer additional user-definable options to including but not limited to:

(1) Display time out options.

(2) Loss of data behavior options.

(3) White point settings.

(4) Red-shift option for tungsten dimming emulation.

k) The fixture shall offer five Quick Set-Ups to allow user to rapidly select different combinations of the numerous user options based on the desired usage situation, to include:

(1) General – for most situations.

(2) Stage – when emulating incandescent fixtures is desired.

(3) High Impact – when maximum output and effect is desired.

(4) XT Arch – when color consistency and architectural characteristics are desired.

(5) Studio - when DMX or stand-alone of white light output is required with intensity, color temperature and color tint control parameters.

l) The fixture shall offer stand-alone functionality eliminating the need for a console.

(1) Fixture shall ship with 24 preset colors accessible as a stand-alone feature.

(2) Fixture shall ship with 12 Sequences accessible as a stand-alone feature.

(3) Each color and sequence can be modified by the end user.

(4) Fixtures can be linked together with standard DMX cables and controlled from designated master fixture.

m) Up to 32 fixtures may be linked.

(1) Fixtures in a stand-alone state shall restore to the settings present prior to power cycling, eliminating the need for reprogramming.

(2) Fixtures without stand-alone operation features described in a, b, c, d, and e shall not be acceptable.

14. The Theatrical Lighting Instruments shall be ETC D40 LED lighting instruments. This Contractor shall furnish the following types and quantities of LED lighting instruments with C-clamp, safety chain and full lens sets:

a) Twelve (12) Desire D40™.

G. 90W MO LED Fresnel Spotlight

1. General

a) The product shall be 0 to 100% controllable by DMX (USITT DMX512-A). The dimming function shall be smooth and continuous. The LED shall turn off below 1%. Products with unstable dimming dynamics shall not be acceptable.

b) The unit shall have Power Factor Correction (PFC)

c) The unit shall be able to internally switch from 8 to 16 bit DMX resolution

d) The luminaire shall meet the UL standards and display a UL and cUL label on the lamphead. Luminaire that do not meet this requirement shall not be acceptable.

2. Physical

a) Its housing should be of lightweight design and finished with electrostatically applied black epoxy paint.

b) Its pan, tilt, and focus shall be manual operated.

c) Its mounting spigot shall be to B.S. standard i.e.: or 1-1/8” diameter, with top reduced diameter to fit directly onto c-clamps with 22mm receivers.

d) Its LED ARRAY, Optics, and Heat Sink shall sit on metal shafts with self-lubricating Teflon bushing for smooth focusing operation. Full focusing action i.e.: from full flood position to full spot position shall take less than 2 turns of the focusing knob or bell cup. Focusing mechanisms that require more than two turns for the complete spot to flood run shall not be acceptable.

e) The total self-weight of the LED Fresnel (Housing and manual operated yoke) shall be less than 17.6 lbs. Heavier units shall not be acceptable.

f) The maximum dimensions shall be (lighting fixture body and yoke)

(1) Maximum Housing length: 10.9”

(2) Maximum Height (measured from the top of the fixture to the bottom of the stirrup without spigot): 15.5”

(3) Maximum Width (including the maximum occupancy of the stirrup) 11.4”

g) Each unit shall be supplied with:

(1) 6” Glass Fresnel lens secured with springs for expansion. Plastic or acrylic lenses are not acceptable.

(2) 4-leaf rotating barndoor

(3) Color frame

h) Each unit shall be equipped with:

(1) POWERCON 20A In and Out panel mounted connectors

(2) XLR 5p In and Out panel mounted connectors in order to allow both Power and DMX Daisy Chain.

(3) Products supplied with non-removable power or DMX cables and without the Daisy Chain ability shall not be acceptable

i) The unit shall have a microprocessor built into the luminaire that shall allow for firmware upgrades as they are available.

XII. 3. Optical

a) The unit shall be equipped with a LED ARRAY of minimum 10X10 LEDS and a rated duration of minimum 50,000 hours. The LED Array shall be mounted on a special heat sink with a central round core and octagonal shape and it shall be equipped with a thermal stabilization system formed by a thermal sensor that activates a silent Sync Jet Fan in case the LED case temperature exceeds 60 degrees C. Products with only heat sinks and no thermal stabilization systems that would only rely on convection cooling shall not be acceptable, as such systems determine a significant variation during the operation time of the white light and therefore an unstable correlated color temperature.

b) The white light emitted shall have a Daylight Balanced Correlated Color Temperature and the white color point shall not change with time. Products with unstable CCT (Correlated Color Temperature) shall not be acceptable.

c) The LED ARRAY shall be supplied with direct current throughout its dimming range. Due to the stable color temperature through the dimming range it is required that the light emission is continuous at any dimming level. Products utilizing PWM for the dimming shall not be acceptable as they may introduce light flickering or flattering in some condition of camera settings (for instance with high speed electronics shutter).

d) Its beam angle when fully spotted shall be less than 12 degrees and when fully flooded shall be more than 60 degrees.

e) The light beam shall produce a central intensity that shall be more than 41.000 candles in spot and more than 5.700 candles in full flood.

f) The projected light beam shall have controllable characteristics as those of a Tungsten Fresnel, meaning softer shadows in spot and harder shadows in flood, with the appropriate barndoor control in flood position.

g) The units shall have a LED engine replacement module that is disassembled by two screws for future upgrade or replacement purposes of the LED engine. Units that cannot demonstrate the

upgrade/replacement of the LED engine shall not be accepted.

h) Provide six (6) 90W DeSisti Fresnel

Part 3 - Execution

I. GENERAL

A. Install equipment in accordance with the approved Shop Drawings, Manufacturer's instructions, and referenced quality standards as indicated herein.

B. Prior to installation inspect the installed work of other trades and verify it is complete to the point where lighting equipment can be installed in complete accordance with the original design and approved Shop Drawings. Ensure that all painting, wet, and dust-producing work is completed. Verify the supporting structures for lighting equipment are acceptable and that no obstructions are present that would preclude installing the devices. In the event of discrepancy, immediately notify the Architect in writing.

1. Verify that job conditions are ready to receive work of this section. Notify architect of any existing condition, which will adversely affect execution. Beginning of execution will constitute acceptance of existing conditions.

2. Verify that field measurements are as shown on shop drawings.

3. Verify that mechanical, electrical, and other items affecting work of this section are in place and ready to receive the work.

II. PREPARATION

A. Protect floor and wall surfaces, building equipment, ductwork, piping, and lights with covers or tarps to prevent damage when installing fixtures and connector strips.

B. All branch load circuits shall be live tested before connecting the power distribution lighting bars.

C. Verify field measurements at the site prior to installation and modify the system accordingly.

III. INSTALLATION

A. Install stage lighting and controls where shown, in accordance with manufacturer's written instructions and with recognized industry practice to ensure that stage lighting equipment complies with applicable requirements of NEW and UL standards and with the applicable portions of NECA's "Standard of Installation" and Trade Standards specified herein and before.

B. All wiring for lighting and control system shall be run in minimum ¾" conduit as hereinbefore specified. All junction box covers shall be identified as hereinbefore specified. All conduits, device mounting boxes, junction boxes, and enclosures shall be securely fastened with appropriate fittings to insure positive ground throughout the entire system.

C. This Contractor shall furnish and install all wiring and make all final connections as indicated in the system manufacturer's shop drawings and standard installation documents. Splices for dimming circuits shall be made only in junction boxes.

D. All wiring shall be checked and tested by this Contractor to ensure the system is free from grounds, opens, and shorts.

E. It shall be the responsibility of the Contractor performing the work in this section to coordinate with the theatrical rigging system Contractor for the proper installation and operation of the theatrical lighting, wiring devices, cables, supports, etc.

F. All work shall be under the supervision of a field engineering technician, accredited by the system manufacturer. It shall be the responsibility of this technician to check and inspect the installation to the Owner's and Architect/Engineer's satisfaction.

IV. PERSONNEL TRAINING

A. A field engineering technician, accredited by the system manufacturer shall provide a minimum of four (4) hours of training for the Owner's operating personnel on the proper operation and troubleshooting of the lighting control system equipment.

V. OPERATING AND MAINTENANCE INSTRUCTIONS

A. At the completion of the installation, the manufacturer shall furnish four (4) final sets of "as-built" drawings as well as manuals of instruction as to the proper operation and maintenance of the lighting control system. "As built" drawings shall include all field modifications. Formal turn-on and instruction shall be provided to the Owner's officially designated representative within fourteen (14) days of a written request by the Owner.

B. This Contractor shall furnish the Owner's officially designated representative(s) with a minimum of four (4) hours of on-the-job instructions in the operation, maintenance, and diagnostic testing of the system. (This shall not be part of the system turn-on specified above.) This Contractor shall also furnish the Architect/Engineer four (4) bound copies of complete operating and maintenance instruction manuals of the lighting control system including circuit diagrams and all other information necessary for proper operation and service maintenance.

VI. SYSTEM TEST

A. This Contractor shall conduct an operating test of the complete system. The system shall test free from grounds, shorts, and other faults. All connections shall be thoroughly checked for mechanical and electrical connections. All lighting control system equipment shall be demonstrated to operate in accordance with the requirements set forth in these Specifications and as shown on the Drawings.

B. This Contractor shall perform all tests in the presence of the Architect/Engineer. This Contractor shall furnish all personnel and test instruments for use in the test.

VII. WARRANTY

A. This Contractor shall deliver the work in a first-class operating condition in every respect.

B. This Contractor shall warrant that the material, equipment, and workmanship furnished shall be entirely free from defects. Any material, equipment, or workmanship in which defects may develop before or during the warranty period shall be repaired or replaced at the Contractor's own expense. Refer to SECTION 01740 for the start of the warranty period. The Contractor shall further warrant that all material, equipment, and workmanship used in the installation, but not specifically mentioned in the Drawings and Specifications, is the best of their respective kinds and that the construction and installation was performed in accordance with the best accepted standard practices in all details.

C. The lighting control system manufacturer shall be prepared to offer a service contract for the maintenance of the system after the warranty period.

VIII. DEMONSTRATION

A. Operation and Maintenance Training: Provide a total of two (2) hours of training with this equipment.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include furnishing and installing Sports Field Lighting System(s), and Sports Field Lighting Control and Monitoring System(s) complete as shown on Drawings and as herein specified.

B. The Sports Field Lighting Systems shall include field lighting luminaires, egress/entry luminaires, and support structures to include: poles; foundations; crossarms; service platform cage assemblies; and other appurtenances, complete as shown on Drawings and as herein specified.

C. The Sports Field Lighting Control and Monitoring System shall be for the control of Sports Field Lighting System(s) and other equipment as shown or indicated on the Drawings, detailed in the manufacturer submittal and as further defined herein. Contractor is solely responsible to verify quantity, installation locations and wiring requirements for this project.

1. The systems shall include but not be limited to microprocessor controlled relay panels controlled via wireless communication based equipment, switches, and Digital Time Clock (DTC), and other devices to provide the required functionality of the system. The system shall also include contactors, cabinets, interface cards, and other devices or equipment as shown on the Drawings. Requirements are indicated elsewhere in these specifications for work including, but not limited to, raceways and electrical boxes and fittings required for installation of control equipment and wiring.

D. Specific manufacturers' catalog numbers, when listed in this section are for reference only. It is the responsibility of this Contractor to verify with the lighting control manufacturer all catalog information and specific product acceptability.

III. DEFINITIONS

A. Constant Light System:

1. A system with an automatic power adjustment to achieve a lumen maintenance control strategy as described in the IESNA Lighting Handbook, Ninth Edition, Chapter 27.

B. Coefficient of Variation (CV):

1. A measure of the weighted average of all relevant illuminance values. Defined by IESNA Lighting Handbook, Ninth Edition, Chapter 20.

C. Design Documents:

1. Documents, including drawings, calculations, and material and product specifications prepared to obtain acceptance by Owner and authorities having jurisdiction.

D. Horizontal Illuminance:

1. Illuminance measured in footcandles (FC), on a horizontal surface three (3) feet above the playing surface (ground), unless otherwise indicated.

E. Illuminance:

1. Concentration of incident light falling on a surface.

F. LC: Lighting Certified

G. Light Trespass: Light spill into areas and properties outside the playing areas, which is either annoying or unwanted.

H. LLD:

1. Lamp lumen depreciation. The fractional loss of lamp lumens at rated operating conditions that progressively occurs during lamp operation.

I. LLF:

1. Light loss factor. Factor used to adjust lighting calculations from initial values obtained in a controlled laboratory environment to maintained values in actual field conditions.

J. Support Assembly:

1. Includes poles or other support structures, brackets, arms, appurtenances, base, anchorage, and foundation.

K. Target Illuminance:

1. Illuminance level used for calculations during system design to determine if the system meets a desired performance standard.

L. Vertical Illuminance:

M. UG: Uniformity gradient; the rate of change of illuminance on the playing field, expressed as a ratio between the illuminances of adjacent measuring points on a uniform grid

1. Illuminance, measured in footcandles, in two (2) directions on a vertical surface, at an elevation coinciding with plane height of horizontal measurements, unless otherwise indicated.

IV. LIGHTING PERFORMANCE

A. Illumination Criteria:

1. BASEBALL/SOFTBALL

a) Minimum Average Target Illumination: 50 FC infield and 30 FC outfield.

b) Maximum-to-minimum Uniformity Ratio: 2:1 infield or less and 2.5:1 outfield or less.

c) CV: 0.17 or less infield and 0.21 or less outfield.

2. FOOTBALL/STADIUM*

a) Minimum Average Target Illumination: 30 FC

b) Maximum-to-minimum Uniformity Ratio: 3:1 or less.

c) CV: 0.25 or less.

3. TRACK AND FIELD*

a) Minimum Average Target Illumination: 20 FC track (at surface of track) and 30 FC for field event areas and all areas inside the track.

b) Maximum-to-minimum Uniformity Ratio: 4:1 or less.

c) CV: 0.3 or less.

d) *The football/stadium includes the track and field playing surfaces as well as other sports such as soccer and lacrosse. Stadiums shall have the entire area inside the track lighted to a minimum average target illumination of 30 FC and the track lit to a minimum average target illumination of 20 FC. FIELD EVENT areas (such as pole vaults, broad jumps, etc.) located outside of the track shall have these areas lit to a minimum average target illumination of 30 FC. This criterion is the same for standalone TRACK and FIELDS.

B. Illumination Calculations:Computer-analyzed point method complying with IESNA RP-6 to optimize selection, location, and aiming of luminaires. All calculations shall be measured 36 inches above the playing field, unless otherwise indicated. Manufacturers utilizing a constant light (or continuous light) system shall use automatic power adjustments to achieve a lumen maintenance control strategy as described in the IESNA Lighting Handbook Ninth Edition, Lighting Controls Section pages 27-2 and 27-3: “Lumen maintenance control strategy calls for reducing the initial illumination of a new system to the designed minimum level. As lumen depreciation occurs, more power is applied to the lamps in order to maintain constant output.” Manufacturers not using a constant light system shall base their calculations on a 0.69 LLF.

C. Computer-analyzed illumination calculations shall include, but not limited to, the following:

1. Grid Pattern Dimensions: For playing areas of each sport and areas of concern for spill-light control, correlate and reference calculated parameters to the grid areas. Each grid point represents the center of the grid area defined by the length and width of the grid spacing. The grid pattern dimensions shall generally be 30 feet by 30 feet, unless indicated otherwise. Each grid point shall be considered a field test station for purposes of field testing described later in these specifications.

2. Spill-Light Control: Minimize spill light for each playing area on adjacent and nearby areas. These levels shall be initial footcandles and shall be measured at a maximum distance of 150 feet from the boundary of the playing field(s). Alternative distance must be approved by owner in writing.

    a) Prevent light trespass on properties near the playing field(s) as defined by Prince George's County Lighting Ordinance [], Prince George's County's Outdoor Lighting Standards and these specifications.

    b) For areas indicated on the Drawings as "Spill-Light Critical", limit the level of luminance directed into the area from any luminaire or group of luminaires, and measured 36 inches above finished grade to the following:

        (1) Maximum Horizontal Illuminance: 0.5 FC.

        (2) Maximum Vertical Illuminance from the direction of the greatest contribution of light: 0.8 FC.

    c) Calculate the horizontal and vertical illuminance due to spill light for points spaced 20 feet apart in areas indicated on the Drawings as "spill-light critical" and 30 feet apart in other "non-critical" areas, to ensure that design meets above limits. Each spill-light point shall be considered a field test station for purposes of field testing described later in these specifications.

3. Glare Control: Minimize direct glare in adjacent and nearby areas and properties. These levels shall be measured at a maximum distance of 200 feet from the boundary of the playing field(s). Alternative distance must be approved by owner in writing.

    a) The intensity of luminaires that may be observed at an elevation of 60 inches above finished grade from nearby areas and properties shall be less than 12,000 candelas when so observed.

    b) The intensity of luminaires that may be observed at an elevation of 60 inches above finished grade from designated "spill-light critical" areas at nearby properties shall be less than 7,000 candelas when so observed.

    c) Calculate and measure the glare points spaced 20 feet apart in areas indicated on the Drawings as "spill-light critical" and 30 feet apart in other "non-critical" areas, to ensure that design meets above limits.

Each glare point shall be considered a field test station for purposes of field testing described later in these specifications.

4. Luminaire Mounting Height: Comply with IESNA RP-6 with consideration for requirements to minimize spill light and glare. Luminaire mounting heights are to the lowest sports lighting luminaire measured above the playing field elevation.

5. Luminaire clusters shall be located outside of the playing field glare zones defined by IESNA RP-6.

6. Egress/Entry Lighting: Provide tungsten-halogen luminaires to provide an average of 1.0 FC illumination measured at grade in spectator and spectator egress/entry areas. These luminaires shall operate upon initial activation of the sports field lights and upon deactivation of the sports field lights. Momentary power interruptions shall activate the egress/entry lighting immediately following restoration of power to the lighting circuits. The duration of these lights illumination shall not be less than 15 minutes, for each occurrence stated above, and then automatically extinguished.

V. QUALITY ASSURANCE

A. Sports field lighting systems and the control systems shall meet the requirements of the National Electrical Code (NEC), state and local codes, including Prince George's County's Outdoor Lighting Standards, and these Specifications.

B. The entire sports field lighting system, which includes the support assemblies, shall be listed by Underwriters Laboratories, Inc. (UL) as a system as well as each individual component having its own UL listing or classification.

C. The Sports Field Lighting Controls and Monitoring System lighting control panels (LCP) shall be UL 916 Listed. LCP's controlling emergency operation by a relay panel shall fully comply with NEC 700.9(B). This Contractor is responsible for verifying compliance.

1. Control wiring shall be in accordance with the NEC requirements for Class 2 remote control systems, Article 725 and manufacturer's specification and requirements.

D. All materials used shall be new and of good quality conforming to these specifications and the successfully reviewed submittals. Any material not successfully reviewed by the Architect/Engineer that is incorporated in the work, used or delivered to the site, shall be immediately removed upon the order of the Owner or Architect/Engineer and replaced to the satisfaction of the Owner and Architect/Engineer at this Contractor's expense.

VI. SUBMITTALS

A. This Contractor shall furnish submittals for the **Sports Field Lighting System(s)** in accordance with SECTION 16010 of these Specifications. Submittals for review shall include but not be limited to the following:

1. Design Calculations for the following:

a) Target Illuminance(s).

b) Complete computer-generated point-by-point photometric calculations of horizontal and vertical illuminance, at minimum grid size and area for each sports field(s).

(1) The exact quantities of luminaires may differ from the original design, but the required footcandle levels, CV, uniformity ratios, spill-light and glare control must be maintained using the same design criterion shown on the drawings and/or specified herein. Should the luminaire manufacturer require additional luminaires to achieve the stated footcandle levels, uniformity and/or require additional branch circuit wiring, supports, support assembly, etc., in conjunction with these additional luminaires, shall not cause additional expense to the Owner.

c) Computer-generated spill/glare analysis in accordance with the lighting performance specifications.

d) Total electrical load, in kilowatts, of lighting system and for each individual pole.

e) Calculations of source intensity of luminaires observed at eye level from indicated properties near the playing field.

2. Electrical system design calculations for the following:

a) Short-circuit current calculations for rating of panelboards.

b) Total connected and estimated peak-demand electrical load, in kilowatts, of lighting system.

c) Capacity of feeder required to supply lighting system.

3. Wiring requirements, including required conductors and cables and wiring methods.

4. Structural analysis data and calculations used for pole selection.

5. Provide an aiming plan for each sports luminaire.

6. Manufacturers bidding any form of a constant light system must include in the shop drawing submittal an independent test report certifying the system meets the lumen maintenance control strategy as hereinbefore described and verifying the field performance of the system for the duration of the useful life of the lamp based on lamp replacement hours. Report shall be signed by a licensed Professional Engineer with outdoor lighting experience who is additionally Lighting Certified (LC) by the National Council on Qualifications for the Lighting Professional.

7. Provide pole and foundation design drawings signed and sealed by a Professional Engineer registered in the state of Maryland. Pole drawings shall indicate the design criteria, assumptions, codes, standards, and all foundation reaction forces and moments. Foundation drawings shall indicate the design criteria allowable soils bearing pressures, codes, standards, all foundation reaction forces and moments, construction specifications, materials, and specific installation requirements such as shoring or de-watering. For the purpose of this bid, the Contractor shall assume the following type of sub-grade material specified in the current adopted edition of the International Building Code, Section 1804, Table 1804-2 – Allowable Foundation and Lateral Pressure:

    a) Soils – Class 5 (clay and sandy clay)

8. Provide data and drawings for all lighting system equipment, service platforms, crossarms and other accessories specified herein and as shown on the Drawings.

B. This Contractor shall furnish submittals for all components of the **Sports Field Lighting Control and Monitoring System(s)** in accordance with SECTION 16010 of these Specifications. Submittals for review shall include but not be limited to the following:

1. Shop Drawings: Submit dimensioned drawings of complete lighting control systems and accessories including, but not necessarily limited to, relay panels, switches, DTC, contactors, cabinets, and other interfaces. Shop drawings shall indicate exact location of each device. Plans shall be diagrammatical. “Cut Sheet” submittals not acceptable.

2. Product Data: Submit for approval manufacturer’s data on the specific lighting control and monitoring systems and components. Submittal shall be in both electronic and hard copy formats. To prevent departures from approved system operation, electronic file submitted shall be able to be directly downloaded to the specified system at the manufacturer’s facility. Submit a complete bill of materials with part numbers, description and voltage specifications.

3. One Line Diagram: Submit a project specific one-line diagram of the system configuration indicating the type, size and number of conductors between each component. Submittals that show typical one-line or riser diagrams are not acceptable.

4. Schematics: Submit wiring schematics for switches and remote control system including all relays and contactors.

5. Programming Forms: Submit programming forms with complete information describing the operation of the lighting control system and all other information necessary to show proper operation of the system.

VII. QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Manufacturer Qualifications: Manufacturer's responsibilities include fabricating sports lighting and providing professional engineering services needed to assume engineering responsibility.

1. Engineering Responsibility: Preparation of delegated-design submittals and comprehensive engineering analysis by a qualified professional engineer.

C. Luminaire Photometric Data Testing Laboratory: By manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

D. Luminaire Photometric Data Testing Laboratory: By an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL.

E. Field Testing Agency Qualifications: An independent testing agency that is accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products, or an NRTL as defined in 29 CFR 1910, with the experience and capability to conduct field testing according to IESNA LM-5.

F. Field Testing Agency Qualifications: A qualified independent professional engineer not associated with Contractor or lighting equipment manufacturer.

G. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel" and AWS D1.2/D1.2M, "Structural Welding Code -Aluminum."

H. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

VIII. SPARE PARTS AND LAMPS – SPORTS FIELD LIGHTING SYSTEM

A. The Contractor shall furnish to the Owner at the completion of the project, a minimum of 10% spare lamps for each type and wattage installed on the project. The quantities of spare lamps shall be by the case (minimum of six lamps per case for the quarts halogen and twelve lamps per case for the HID). Loose lamps, not in a case or in a partial case are not acceptable.

B. The Contractor shall furnish to the Owner at the completion of the project, a minimum of 10% spare fuses of each type used for the luminaires. Fuses shall be in manufacturer’s boxed containers. Loose fuses or partially boxed are not acceptable.

C. Spare lamps and fuses shall be stored on site as directed by the Owner.

IX. SPARE PARTS – SPORTS FIELD LIGHTING CONTROL AND MONITORING SYSTEM

A. Provide 10% spare relays per Lighting Control Panel, up to the maximum capacity of the LCP. If the LCP is fully populated provide a minimum of two relays per relay type (N.O. or N.C.) in the panel.

B. Provide CD version of manufacturer’s operating software to include graphical interface

software. Software shall be the latest version.

C. Provide 2 extra sets of as-built and operating manuals.

D. Provide 10 spare keys for each key operated switch.

X. DESCRIPTION – SPORTS FIELD LIGHTING SYSTEM

A. This Contractor shall furnish and install sports field luminaires complete with diffusers, louvers, glassware, gaskets, shims, wiring, control, conduit, hardware, ballasts, and other appropriate devices and parts for a complete exterior weatherproof sports field lighting system installation. Adjustable fixtures shall be aimed in accordance with the luminaire manufacturer's recommendations. Each luminaire shall be installed by this Contractor complete with the proper type of new lamp(s).

B. Poles and support assemblies shall be designed and constructed so that all wiring and grounding facilities are concealed. All handholes, wire inlets/outlets, inserts for pole steps, thru-bolt holes and ground wire shall be cast or fitted into the pole during the manufacturing process.

C. **For football/stadiums,** each pole design shall provide for a minimum of four (4) additional future luminaires per pole to allow future upgrades to the illumination levels on the playing fields. This shall include electrical loads and provisions for installing the future luminaires.

XI. DESCRIPTION – SPORTS FIELD LIGHTING CONTROL AND MONITORING SYSTEM

A. The Sports Field Lighting Control and Monitoring System shall be a microprocessor controlled wireless control system that controls and monitors the operation of sports field lighting. The system shall be comprised of Lighting Control Panel(s), suitable cabinet enclosures, contactors, relays, TCP/IP communication link and control software to provide the required functionality.

1. The system shall monitor lighting performance and notify the manufacturer if individual luminaire outage is detected so that appropriate maintenance can be scheduled. The manufacturer shall notify the Owner of outages within 24 hours, or the next business day. The controller shall determine switch position (Manual or Auto) and contactor status (open or closed).

2. The system shall allow the Owner and users with a security code to schedule on/off system operation via a web site, telephone, fax or email up to ten (10) years in advance. Manufacturer shall provide and maintain a two-way TCP/IP communication link. Trained staff shall be available 24/7 to provide scheduling support and assist with reporting needs. The Owner may assign various security levels to schedulers by function and/or fields. This function must be flexible to allow a range of privileges such as full scheduling and capabilities for sports fields, to only having permission to execute "early off" commands by telephone. The controller shall accept and store 7-day schedules, be protected against memoryloss during power outages, and shall reboot once power is restored and execute any commands that would have occurred during said power outage.

3. Manufacturer of the systems shall include communications costs for the operation of the controls and monitoring systems for the length of the warranty and maintenance period.

4. Manufacturer shall provide a web-based database of actual field usage and provide reports by facility and user group.

XII. ALTERNATIVE SYSTEMS

A. Compliance to Specifications: Acceptance of alternative (substitution) systems or equipment does not negate the Contractor and the lighting and control manufacturer's responsibility to comply fully with the requirements of these specifications. Any exceptions to the specifications must be clearly stated in the 10-day Prior Approval submittal documents. Refer to specification sections 16010 and 01630.

B. Lighting Performance Requirements: Manufacturer shall provide computer models guaranteeing the lighting performance, hereinbefore described under LIGHTING PERFORMACE, for a period of 25 years. If a constant light level cannot be provided, a maximum Recoverable Light Loss Factor of 0.69 shall be applied to the initial light level design to achieve the maintained light levels. For alternative systems, scans for both initial and maintained light levels shall be submitted. All computer-generated models shall also include the spill-light control and glare control criterion.

C. Revised Electrical Distribution: Manufacturer shall provide revised electrical distribution plans to include any changes to the electrical service entrance, panelboards, branch circuits, wire sizing, etc. associated with an alternative system or equipment.

D. Associated Costs: Contractor and the lighting system and controls manufacturer shall be responsible for any additional costs associated with an alternative system or equipment, including engineering costs from the engineer of record.

Part 2 - Products

I. MANUFACTURERS

A. It is the intent of these specifications that the Sports Field Lighting System and the Sports Field Lighting Control and Monitoring System manufacturer be the same manufacturer in order to have a complete sports field lighting system and control system from a single manufacturer. Such firms shall be regularly engaged in the manufacture of sports lighting equipment and lighting control equipment and ancillary equipment, of types and capacities necessary to provide the required functionality, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Acceptable Sports Field Lighting System Manufacturers shall be: MUSCO LIGHTING, LLC (Light-Structure Green) or approved equal.

C. Acceptable Egress/Entry Luminaire Manufacturers shall be COOPER-LUMARK (LQL Series), DAY-BRITE (NQF Series), GENERAL ELECTRIC (QF Series), HUBBELL (QL Series), and LITHONIA (F1500 Series), or as shown on the Drawings.

D. Acceptable Hybrid Steel Pole with Pre-stressed concrete foundation base manufacturers shall be MUSCO LIGHTING, LLC, or approved equal.

E. Acceptable Service Platforms and Crossarm Brackets manufacturers shall be MUSCO LIGHTING, LLC or approved equal.

F. Acceptable Sports Field Lighting Controls and Monitoring System manufacturers shall be MUSCO LIGHTING, LLC [Basis of Design] or approved equal.

G. The listing of the above products and manufacturers does not constitute automatic approval or final acceptance. Products must meet the lighting performance and control requirements. It is the Contractor's responsibility to verify and document that any product selected from the above list does meet the requirements of these specifications.

II. LUMINAIRES

A. SPORTS LUMINAIRES

1. The sports luminaires shall be heavy-duty weather resistant floodlights for operation of one (1) 1500-watt metal halide lamp. The beam spreads (horizontal X vertical) shall be of the IES/NEMA types as necessary to provide an even illumination on the field. The floodlights shall be UL1572 listed SUITABLE FOR WET LOCATIONS. The floodlight shall have a decal indicating reflector identification viewable from the ground. Standard construction shall be IP55.

2. The sealed optical assembly shall include a hinged door with stainless spring steel door latches, tempered door glass, silicone rubber door gasket, a one-piece parabolic spun aluminum finished reflector protected inside and out by a protective finish, and a heavy duty, heavy gauge aluminum outer housing (shroud) or die cast housing protected inside and out with an electrocoat paint finish. All external hardware shall be of a corrosion-resistant material or protected by a corrosion-resistant finish. Each optic shall be filtered to optimum performance throughout the life of the luminaire. Luminaires shall include a spill-light/glare control reflector shields and/or visors.

3. Each floodlight luminaire shall operate from a remote ballast. Remote ballasts shall be provided in a weather resistant enclosure mounted on the same pole as the luminaires and have concealed wiring within the pole. Refer to the Electrical Component Enclosure section described hereinafter in these specifications for ballast information and fusing.

4. The mounting hardware shall be heavy-gauge steel protected by a weather-resistant coating. The mounting hardware shall be capable of allowing the floodlight to be moveable in all directions, containing degree markers and a repositioning stop. Each luminaire shall be pre-aimed. Each luminaire aiming location shall be verified in order to comply with IESNA recommendations. Each luminaire shall have a memory positioning device for automatic repositioning after re-lamping. To ensure added durability, luminaire visors/glare shields and platform/crossarm shall withstand 125 mph winds and maintain luminaire aiming alignment.

B. EGRESS/ENTRY WALK-WAY LUMINAIRES

1. Walkway luminaires shall be a heavy-duty, weather-resistant floodlight for operation of one (1) 1500-watt tungsten-halogen (quartz) lamp. The floodlight shall contain a complete optical assembly with 6x5 NEMA type beam spread (horizontal X vertical), prewired with leads for connection to the power source. The floodlight shall have a NEMA lamp identification decal. The floodlight shall be UL 1572 listed and labeled SUITABLE FOR WET LOCATIONS. Standard construction shall be IP55.

2. The floodlight shall include die-cast aluminum housing with an electrocoat paint finish, hinged front door frame, built-in aiming sight and ½-inch standard tapered pipe tread swivel mount. All external hardware shall be of a corrosion-resistant material or protected by a corrosion-resistant finish.

3. The optical assembly shall include a tempered, clear, heat and shock resistant door glass, a one-piece aluminum reflector and twin compressible sockets.

C. LAMPS

1. Lamps shall be furnished and installed by this Contractor in each of the luminaires as shown on the Drawings and as indicated in these specifications.

2. Lamps shall be manufactured by GENERAL ELECTRIC, OSRAM/SYLVANIA, or PHILLIPS unless otherwise noted.

3. All phosphor coated lamps shall be the color corrected type.

III. POLES

A. POLE STRUCTURES

1. Pole structures shall be multi-sectional and shall consist of one of two types, but only one type may be selected for use on this project. The types of pole structures are as follows:

   a) Hybrid Steel and prestressed concrete multi-section pole with the prestressed concrete base foundation designed for direct embedment.

   b) Steel multi-section pole with a cast-in-place concrete anchor bolt foundation.

2. Steel poles direct embedded are not acceptable.

3. Poles shall be designed considering the application of both dead load and wind load. The moment at any point along the length of the pole is to be the sum of moments resulting from dead loads and forces from wind loads. The wind force is to be computed by multiplying the specified wind pressure by the effective projected area (EPA) of the individual components.

4. The P-Delta secondary moments due to the deflected unbalance of the structure must be accounted for in the design and shown in the calculations submitted.

5. Poles shall be designed to meet AASHTO requirements for wind loading and shall be designed such that the deflection does not exceed 1.1% of the free height of the pole at its maximum EPA under a wind loading equivalent to ½ the designated ultimate wind speed, including a 1.3 gust factor.

    a) Each football/stadium poles EPA shall include an additional future four (4) sports luminaires and mounting hardware, including additional crossarms and/or larger platform cages, if necessary.

6. The natural frequency of the pole shall be limited to 0.8 cycles/sec. The manufacturer shall provide calculations verifying the above requirements.

7. Pole heights shall be determined to provide a mounting height above the playing field sufficient to meet the specified lighting requirements. Luminaire mounting heights are to the lowest mounted sports lighting luminaire(s) measured above the playing field, not the grade location of the pole(s).

B. POLE MATERIALS for PRESTRESSED CONCRETE POLE BASES

1. The specification contained herein shall be for the prestressed concrete foundation portion of hybrid steel and concrete multi-sectional pole.

2. The concrete mix shall be designed to achieve a minimum 28-day compressive strength of 9,500 psi. Concrete test reports shall be kept per ASTM C-39. Cement shall conform to the latest requirements of Type I or III Portland Cement in accordance with ASTM-C150. Maximum size aggregate may be ¾ inch or 75% of the clear spacing between main reinforcing steel and surface of pole. Any water reducers, retarders, or accelerating admixtures shall conform to ASTM-C494. Water shall be free from foreign materials in amounts harmful to concrete and embedded steel.

3. Reinforcing Steel – Deformed steel reinforcement shall conform to requirements of ASTM A615 for Grade 60 Rebar.

4. Pre-stressing Steel – Pre-stressing steel reinforcement shall conform to uncoated 7-wire, stress relieved strand (including low relaxation) per ASTM-A416.

5. Spiral Reinforcement – Steel spiral reinforcement shall conform to the requirements of ASTM-A82 and shall not be less than .150-inch diameter. The pitch of the spiral steel shall not be greater than 4 inches or the radius of the pole, whichever is less.

6. Hardware – All structural steel shall conform to ASTM-A36 and be hot- dipped galvanized in accordance with ASTM-A123 or ASTM-A153 as applicable. Zinc alloy AC41A for inserts, handhole frames and covers, shall conform to ASTM-B240. All bolts, nuts, washers and other fasteners must be either

stainless steel or hot-dipped galvanized to resist corrosion.

7. Manufacture of Pre-Stressed Concrete Poles:

    a) All manufacturing tolerances, details of reinforcement and finishes shall be in accordance with “Guide Specification for Prestressed Concrete Poles”, as published in the May-June, 1982 issue of the Journal of the Prestressed Concrete Institute.

    b) Poles shall be prestressed concrete poles, manufactured by the centrifugal spinning process. Poles shall be round in cross section with a hollow center.

    c) Forms shall be designed to provide a continuous taper of +/- 0.16 inches per foot of length and provide a minimum of ¾” of concrete coverage over the longitudinal steel.

    d) Poles shall have a smooth natural form finish, soft gray in color.

    e) The manufacturer shall have 10 years experience in the design and production of centrifugally spun concrete poles and be a “PCI-Certified Facility.”

    f) All cable entry holes shall be free from sharp edges for passage of electrical wiring. All handhole frames shall be composed of rugged high density cast zinc.

8. Pole Accessories:

    a) A nameplate shall be cast into the wall of the pole approximately 5 feet above the ground line identifying the name of the manufacturer, overall length, weight, manufacturer date, class and fabrication number.

    b) A 3” x 12” or 4” x 10” conduit entrance opening shall be centered 18” below grade (depending on pole size).

    c) A 3.5” x 10.5” handhole frame with flush cover shall be centered approximately 36” above grade.

    d) A 2.5” x 8.5” handhole frame with flush cover shall be located 180 degrees from disconnect switches and/or electrical equipment cabinets that are pole mounted.

    e) All poles shall be provided with pull cordage to facilitate cable installation.

    f) Provisions shall be made for attaching and wiring any disconnect switches or other electrical components not covered herein but required to complete the project.

C. POLE MATERIALS for MULTI-SECTION STEEL POLES

1. The specification contained herein shall be for full length multi-sectional steel poles or for the steel portion(s) of the hybrid steel and prestressed concrete foundation multi-sectional pole.

2. The pole shaft shall be constructed of low carbon, tapered tubular steel conforming to ASTM A595 Grade A or ASTM A572 Grade 65. A non- tapered section of pole conforming to ASTM A513 may be used at the top of the pole for luminaire crossarms and/or platforms. The overlap telescoping joint of pole sections shall be by slip fitting the top section over the lower section by a length that is the larger of 2 feet or 1.5 times the diameter of the inside of the female tube. All sections shall maintain a uniform taper from top to bottom.

3. There shall be at least one longitudinal seam weld in the tapered section of the shaft. The longitudinal seam weld shall have at least 60% penetration, except in the areas where the shaft section telescopes over another. In overlapping areas, the weld penetration shall be 100%. No circumferential weld splices may be used in fabricating the shafts.

4. The pole shaft shall be hot dip galvanized after fabrication to conform to ASTM A123. To ensure a high quality galvanized coating with good adherence, all steel components used for the pole shaft, luminaire crossarm, and other attachments must be of a steel content that conforms to ASTM A385.

5. All exposed steel components of the pole shall be at least 18 inches above the surface of the ground to avoid exposure of the steel to the heavily moisture and oxygen laden air, both above and below the surface. There shall be a cap to cover the top of the pole and covers for all access openings in the pole wall so that rain will not enter the interior of the pole. To avoid stress corrosion of the pole, there shall be no critical stress points of the steel portion of the pole within 18 inches of the ground.

6. All fasteners and attaching hardware shall either be stainless steel or be hot dip galvanized to conform to ASTM A153.

7. Hand Holes shall be peripherally reinforced with flat bar which shall be integrally welded to the plate shaft. Hand holes shall be minimum 4” x 6” and located at each platform/crossarm level for use during installation and maintenance of electrical wiring. Hand holes shall also be located 180 degrees from each disconnect switch and/or electrical equipment cabinet that are mounted to the pole. One 4” x 10.5” hand hole shall be located two to six feet above finished grade with a ground lug welded inside the pole opposite this hand hole. Cover plates shall be included with each hand hole and attached to the pole with a black bar and screw.

8. Top wiring shall be through a threaded coupling suitable for the diameter of the pole, with access by the way of a hand hole. A suitable wire hanger(s) shall be provided at top coupling locations for use with a wire mesh grip.

9. Pole assemblies which exceed 50 feet in height shall have an internal cable

guide and strain relief mechanism, which is typically attached at the mid-height of the pole assembly. The cable guide assembly shall consist of an offset bar, steel pipe sleeve with internal PVC sheathing to reduce wear, and a handhole opposite the offset bar access.

10. Steel poles using a cast-in-place concrete anchor bolt foundation design shall have a base plate. The base plate shall be a structural quality hot rolled carbon steel plate that meets or exceeds ASTM A36 with a minimum yield of strength of 42,000 psi. The base plate shall telescope the pole shaft and have a circumferential weld on the top and bottom or shall have a full penetration butt weld with a backup bar. The anchor bolt holes shall be slotted and be a minimum ¼" larger than the diameter of the anchor bolts used on the pole.

11. Anchor bolts shall be fabricated from a commercial quality hot rolled carbon steel bar that meets or exceeds minimum yield strength of 55,000 psi. Anchor bolts shall be sized according to each pole design and furnished with two (2) galvanized flat washers. Anchor bolts shall be galvanized a minimum of 6" on the threaded end in accordance with ASTM A153. Typically, the anchor bolts will ship with the poles.

D. POLE FIELD APPLIED LABELS

1. Labels shall be attached to each sports field lighting pole identifying each poles designation, as shown on the Drawings. Labels shall be pressure- sensitive type, suitable for exterior use. Labels shall have bright contrasting colors with letters minimum 2" high or greater. Locate labels at 10'-0" above finished grade on two sides of the poles, with one side visible from the field side. Poles located behind stadium bleachers or other structures shall have the labels located at a height visible from the field.

2. Labels shall be UV sunlight resistant.

IV. FOUNDATIONS

A. The sports field lighting system manufacturer shall provide foundation designs to suit their lighting system. Geotechnical information (Boring Logs) have been provided on the Boring Location Plan to assist in foundation design, if required.

B. For purposes of this Bid, or in the absence of geotechnical information, the Contractor shall assume the following type of sub-grade material specified in the current adopted edition of the International Building Code, Section 1804, Table 1804.2 "Allowable Foundation and Lateral Pressure":

1. Soils – Class 5 (Clay and Sandy Clay).

C. Foundation size, shape, depth of embedment, and backfill material shall be determined by the manufacturer's structural engineer. Manufacturer shall provide suitable concrete foundations to support anticipated pole loading based on load carrying capacity of existing soil conditions as hereinbefore described. The design of the support structure and foundation shall be signed and sealed by a licensed Professional Engineer registered in the state of Maryland. The design shall include the following minimum

requirements:

1. Use Broms safety factor of three (or IBC) in the foundation design.

2. Foundation strength shall allow the concrete to harden on any concrete portions of the pole in which steel components that provide tension strength are contained, for a minimum of 28 days before design loads of pole attachment are applied.

3. Concrete material:

   a) Cast-in-place concrete foundations shall be constructed of not less than 3,000 psi.

   b) Pre-stressed concrete poles as hereinbefore described.

   c) The steel reinforcement within the concrete shall be protected from slippage and exposure to oxidation through voids in the concrete or exposure of the steel through porous concrete material. Provide cover as specified in ACI-318.

D. Excavation is unclassified soil and includes excavation to sub-grade elevations indicated regardless of character of materials and obstructions.

V. SERVICE PLATFORM CAGE ASSEMBLY

A. Platform cages shall be provided on all sports field lighting poles, unless specifically shown on the Drawings as not requiring a platform cage. Poles that may be shown as not requiring a platform cage are based on a maximum of twelve (12) sports luminaires on stacked crossarms as described under CROSSARM ASSEMBLY below.

B. Platform cages shall be OSHA APPROVED and shall be constructed from either tubing or angle iron members, which meets the minimum requirements of ASTM A53 Grade B and ASTM A36 respectively. Tubular members shall have silicone gasketed end caps.

C. Top mounted platform cages shall be mechanically attached to the pole with plates meeting the requirements of ASTM A36 and connecting hardware meeting the requirements of ASTM A325.

D. Side mounted platform cages shall be mechanically fastened to the pole with plates conforming to ASTM A36 and U-bolts fabricated from round stock conforming to ASTM A36. Additional side mounted assemblies may be permitted to establish correct quantity of luminaires.

E. The platform floor shall consist of expanded metal grating and shall incorporate a hinged door for access to the platform. The hinged door shall be capable of closing prior to unlatching any safety climbing devices. Cage railings shall be constructed of flat bar stock or angle iron. Railings constructed of cable or steel rope materials will not be accepted. Cages shall also incorporate a bottom “kick- plate.”

F. The platform cage sections shall be hot dip galvanized in accordance with the

requirements of ASTM A123 specifications. Each cage assembly must be completely coated, inside and out, in a single dip. Double dipping will not be permitted to prevent acid entrapment in compliance with USGA recommended practices. All miscellaneous connecting hardware shall be galvanized in accordance with ASTM A153 specifications.

G. All wiring shall be factory pre-wired enclosed within the system assembly when required by the luminaire manufacturer's lighting system.

H. For ease of maintenance, the system must be capable of re-lamping the luminaires from the front or rear of the assembly.

VI. CROSSARM ASSEMBLY

A. The crossarm assembly shall be designed as a U-bolted, side mount connection. The assembly shall include a four-bolt plate, allowing two U-bolts per arm assembly. The crossarm shall be made of minimum 4" x 4" x 3/8" angle iron. At each luminaire or speaker location drilled holes shall be provided to accommodate the attachment of the luminaire or speaker assemblies. Near each crossarm attachment point a threaded coupling and handhole shall be provided at 90 degrees to allow for electrical wiring and access respectively.

B. The crossarm assembly shall be hot dip galvanized in accordance with the requirements of ASTM A123 specifications. Each assembly must be completely coated, inside and out, in a single dip. Double dipping will not be permitted to prevent acid entrapment in compliance with USGA recommended practices. All miscellaneous connecting hardware shall be galvanized in accordance with ASTM A153 specifications.

C. Luminaires requiring tubular type crossarms shall meet the requirements above and shall be 4" x 2" x 1/8" tubular steel (FTY-46 KSI, ASTM A500 GRADE B) and welded to a 6" C-channel support structure. Crossarms using steel less than 1/8" are unacceptable and length shall not exceed 155". Crossarms shall be hot dip galvanized after fabrication.

D. All wiring shall be factory pre-wired enclosed within the system assembly when required by the luminaire manufacturer's lighting system.

E. Poles not requiring platform cage assemblies, where specifically shown on the Drawings, shall use a stacked crossarm configuration for luminaire mounting with a maximum of three (3) sports luminaires per crossarm and a maximum of four (4) crossarms per pole. If additional sports luminaires or crossarms are required by the lighting system manufacturer, then a platform cage assembly shall be utilized as hereinbefore described.

1. Poles for football/stadium shall include the additional four (4) future sports luminaires in the total count of luminaires on the pole. **[Engineer: Delete this sub-paragraph if football/stadium is not included in this project]**

VII. WELDING

A. Welding shall be in accordance with AWS (American Welding Society) Structural Welding Code's most recent edition. Welders certified in accordance with the AWS

Code shall perform welding. Welds shall be free of cracks and under- cutting, and shall be 100% visually inspected with questionable areas inspected by the magnetic particle non-destructive process.

VIII. CLIMBING SYSTEM

A. Each pole shall have a Climbing System, whether or not the pole includes a platform cage assembly. The climbing system shall incorporate pole steps, safety climbing cable, and harness.

1. Pole step bolts shall be field installed. Each step shall utilize a minimum 5/8-inch diameter x 6.5-inch-long carriage bolt. Each bolt shall attach by means of a “nut-holder” cast or welded into the pole. Steps shall start 12 feet from the finished grade and continue to within 18 inches of the platform/crossarm. The steps shall be alternately spaced staggered on 15 inch intervals, 90-120 degrees apart. The first set of steps and last two sets of steps shall be “doubled” without staggering.

2. Safety climbing cable shall be 5/16-inch diameter, galvanized steel or stainless steel cable. The cable system shall incorporate a tension spring and intermediate cable guides(s) to insure the cable remains “tight” and offset from the pole shaft. Poles with a platform cage assembly shall have the cable transition into the caged platform assembly in a manner that does not require the climber to disengage the safety belt from the cable prior to entering the caged platform and closing the door.

3. The safety harness assembly shall be OSHA approved for climbing sports lighting support structures. The belt, lanyard, and respective attachment hardware shall be appropriate for the safety cable and step system. One (1) safety harness assembly shall be provided for each sports field lighted system.

IX. WIRING HARNESS

A. Strain Relief – The wiring harness shall be supported at the top of the pole by a stainless-steel wire mesh grip matched to the size of the harness. There shall be not more than 13 conductors supported by a single wire mesh grip. An interim wire mesh grip support shall be located approximately halfway down the pole.

B. Strain Relief Slippage – There shall be protection around the conductors, in addition to the insulation, to protect from damage from the wire mesh grip and also to avoid slippage of the grip on the wire harness. The wire mesh grip shall also be clamped to the harness with a cable tie at the bottom of the grip to avoid loosening.

C. Pole Attachment – The wire mesh grip shall be mechanically attached to the pole with an enclosed mounting loop so that it cannot be accidentally removed in any direction.

D. Spiral Winding – The harness being supported by the wire mesh grip shall consist of multiple #14 A.W.G. (minimum) conductors rated at 600V with 90°C insulation and shall be continuously spiral wound and bound with Mylar wrap to prevent slippage of individual conductors within the wiring harness. Additionally, a cable tie shall be tightly wrapped around the harness at not more than 10-foot increments.

E. Abrasion Bumper – There shall be provided at 2 feet below the wire mesh grip and then at not more than 10-foot intervals along the entire length of the wire harness an abrasion protective bumper device of soft, durable abrasive resistant material not less than 2 inches in diameter attached around the wiring harness to protect the harness from striking and being abraded by the interior surface of the pole.

F. Labeling – All wiring harness conductors shall be color-coded and clearly labeled.

G. Plug-ins – Each end of the wire harness shall be terminated into a plug-in device with conductors sequenced consistent with the pattern of the wiring schematic provided by the Manufacturer.

H. Testing – All conductors and plug-in devices shall be tested for resistance under load for continuity, schematic sequence, and for insulation integrity. Manufacturer shall ship a copy of the test results with the wire harness.

I. Grounding – There shall be included, within the wiring harness, one conductor for use as a grounding conductor. The grounding conductor shall be equal in size to the load carrying conductors.

X. ELECTRICAL COMPONENT ENCLOSURE (ECE)

A. The ECE shall be a NEMA 3R rated, gasketed enclosure to house the ballasts, capacitors, fuses, terminal strips, thermal magnetic circuit breakers and distribution lugs.

B. The ECE shall be divided into two (2) compartments. The upper compartment shall house the ballasts, capacitors, and fuses. The lower compartment shall provide for the thermal magnetic circuit breaker, distribution lugs, and connection of all circuits coming into and out of the ECE.

C. The ECE shall be heavy hot-dip galvanized to ASTM A123 standards after fabrication to a thickness of not less than 3 mils.

D. All latches, hinges and non-current carrying fasteners, outside or inside the enclosure, shall be stainless steel and shall further be coated with a clear thermoset polymer coating such as Empigard to prevent galvanic interaction.

E. The access door of the ECE shall be attached by a full-length stainless steel hinge and shall be secured, when closed, by lockable stainless steel latches.

F. The ECE shall attach to the pole by means of a device, which is sufficient to align the ECE and support its weight. There shall be a sealed joint with a non- threaded connection to provide wiring access from the pole to the ECE for both the primary and secondary circuits. The connection shall be gasketed for watertight protection. All wire passages shall be protected to prevent wire abrasion or damage.

G. In the ECE, capacitor cases shall be made from zinc coated steel or aluminum and top coated with enamel. Each capacitor shall have a ground terminal welded to its case and such terminal shall be connected to ground via a grounding wire. The capacitor case

shall not make direct contact with surface of the ECE.

H. There shall be provided, within the ECE, a UL listed thermal magnetic circuit breaker such that electrical power to all equipment on the pole served by the three-phase feeder circuit shall be disengaged by the operation of one switch. The circuit breaker shall be located in a compartment separated from any capacitors or ballasts.

I. The circuit breaker shall provide landing lugs for the conductors that provide power to the pole.

J. There shall be provided by the Manufacturer a set of distribution terminal blocks, which shall be factory wired from the breaker to the blocks. These blocks shall provide for termination of all ballast connection wiring.

K. There shall be provided an individual fuse for each ballast conductor except neutral conductors which shall not be fused or switched. Fusing must be UL listed. In-line fusing will NOT be acceptable.

L. All lamp supply circuits in the ECE shall be color-coded and labeled and shall be terminated into a UL recognized plug-in device in the lower compartment of the ECE in a manner suitable for plug-in to the wiring harness.

M. The wiring harness circuits from the lamps shall be attached to the ECE circuits by UL recognized plug-in connectors.

N. There shall be provided, in the ECE located in the lower compartment of the enclosure, one equipment-grounding lug rigidly fastened to the enclosure, sized to accept up to a 1/0 conductor. There shall also be provision in the upper compartment for a ground terminal of sufficient size to permit connection of the grounding conductors from the capacitors and the ground wire from the wiring harness.

O. There shall be an individual ballast for each luminaire. The ballast shall be a lead peaked, auto-regulating ballast and be available for use with 480 volt, 3 phase supply. The ballast shall be located remote from the luminaire cross arm and shall be placed approximately 10 feet above ground level. The ballast box must be a NEMA 3R enclosure and must be manufactured by the luminaire assembly manufacturer and all hardware shall be included with the ballast box assembly. The remote ballast system described above shall be located on the same pole as the luminaire assembly in the NEMA 3R enclosure with the capacitors and the capacitors shall operate in ambient air not to exceed 70 degrees Celsius. The assembly design shall be adaptable to various standard ballasts and must retain its U.L. listing.

P. The manufacturer shall provide an electrical schematic of the ECE circuits, which schematic shall be of a durable material and affixed to the inside of the ECE door for use by maintenance personnel.

Q. The ECE shall be attached to the pole with the lower end approximately 10 feet above grade.

R. The ECE shall be listed by UL both for use with 90°C-rated supply conductors and as suitable for use in wet locations.

S. Comply with ANSI C82.4 and be capable of starting at a temperature of minus 30 degrees Celsius.

XI. IN-GROUND CAST HANDHOLES

A. Provide open bottom in-ground cast handhole at each pole location and at location(s) shown on the drawings.

B. Each in-ground cast handhole shall be approximately 18 inches (length) x 11 inches (width) x 18 inches (depth) with a skid resistant cover.

C. The bases and covers for the handholes shall have a load of 22,568 lbs. minimum over a 10-inch square with a minimum test load of 33,852 lbs. The top of the box shall fit flush with the finished grade.

D. The base and covers shall be as manufactured by QUAZITE series “PG” or approved equal.

XII. LIGHTING CONTROL SYSTEM – MATERIALS and COMPONENTS

A. The Sports Field Lighting Control and Monitoring equipment shall include cabinets to house all lighting control panels (LCP), contactors, switches, terminals, digital cellular communications equipment and lighting controls required to control the Sports Field Lighting System(s) as shown on the Drawings and as specified herein.

B. Off-On-Auto switches shall be utilized to manually over-ride the lighting control system. One switch shall be required for each lighting zone or system. Switches shall be supplied with on, off, and auto nameplates and labels clearly identifying the zone by field or location.

C. The lighting system shall be controlled via remote system. In addition to the remote system, On/Off pushbutton control stations (user switch) shall be provided to allow users to turn the Sports Field Lighting System(s) on and off from the field. These on/off controls shall be provided in a weatherproof NEMA 3R pad-lockable box and located as shown on the Drawings. This user switch will allow the users to turn the lights on or off whenever the system is enabled by the remote system, on-site digital keypad, or time clock. The digital keypad enabling switch shall be located within the same weatherproof box as the on/Off control station, unless otherwise noted.

D. The remote lighting system shall include Digital Cellular Communication equipment using wireless technology avoiding both the ongoing and installation costs of utilizing telephone land lines at remote sites. The system shall utilize publicly available wireless communication infrastructure avoiding the cost associated with installing and maintaining a private wireless infrastructure.

1. Digital Cellular Communication Equipment shall have a main power switch for servicing convenience and safety.

E. The remote lighting control system shall also meet the following:

1. A security-code based, 24-hour, remote control system that enables Owner and/or authorized user to remotely enable the system on or off, control the sports field lighting schedule, and monitor the system, using telephone and web based or software driven computer.

2. The remote-control system shall be protected against power outages and memory loss, shall reboot to real-time once power is restored, and execute any commands issued prior to the power outage.

3. The remote-control system shall monitor and provide reports of actual lighting system luminaire usage.

4. On-site equipment shall include manual Off-On-Auto switches to allow for maintenance and manual operation.

5. System shall be capable of operating any given field from multiple computers via the Internet.

6. Zones shall have one or more outputs assigned to them, with the ability to have any outputs assigned to any zone. Outputs shall have the ability to be assigned to multiple zones.

7. System shall have delay-off capability on a per zone basis whereby some of the lighting for a given zone is turned off at the end of the lighting schedule time or the local user switch is turned to the off position, and the balance of the lights are turned off a number of minutes later (user definable), for safety and convenience.

8. LCP's shall allow for user settable overrides on an independent basis for each zone whereby the override is set for either duration of time or set to be cancelled at a specific time decided by the user. If the override is canceled for any reason, the underlying schedule shall run as normal. The override capabilities shall be available to the user remotely or manually at the field.

F. Manual Off-On-Auto Selector Switches

1. For on-site manual control, three position selector switches (Off-On-Auto) shall be factory-mounted in the Lighting Contactor Cabinet.

2. The OFF-ON-AUTO switches shall operate as follows: The three-position switch shall control each lighting zone. In the OFF position, all contactors are open and the local user switch is locked out. In the ON position all contactors are closed independent of or in conjunction with the position of the local user switch. In the AUTO position, the system is under control of the remote-control signal or the time clock and the local user switch is active. The contacts on the OFF-ON-AUTO switch shall be make-before- break so that the switch may be moved between ON and AUTO without de-energizing the circuit.

G. An adequate number of Lighting Control Panels (LCP) shall be supplied to control the required number of zones of control for this project.

H. LCP's shall utilize dry-contact type outputs for switching the control voltage to the lighting contactors.

I. LCP's shall incorporate the appropriate control mechanism to control the type of lighting contactors; regardless of whether the lighting contactors are continuous electrically held, mechanically held latching and unlatching (continuous power OK), mechanically held latching and unlatching (requiring momentary power), etc.; all combined within the same LCP if required.

J. LCP's shall permit the downloading of all data within the unit for analysis via laptop computer or PDA.

K. Override control may be achieved either via the remote manual control switches at the LCP's, or computer; none of which shall be mutually exclusive of the other (e.g., the user may set an override via Web Access, then cancel later at the keypad at the LCP's); all available 24 hours per day, 7 days per week, and all without the user having to contact manufacturer.

L. In *addition* to utilizing Web Access for scheduling, the user shall be able to contact Manufacturer support team 24/7 to enter schedules and request last minute changes.

M. The lighting control system shall automatically adjust for changes in Daylight Savings Time and changes in sunset and sunrise times, on a stand-alone basis not reliant upon a computer or some other system transmitting the information to the units.

N. UL listed Power supply shall be non-linear switching-type power supply.

XIII. LIGHTING CONTROL SYSTEM CABINETS

A. The Lighting Control and Monitor Systems equipment shall be housed in suitable cabinets, including lighting contactors. The manufacturer shall determine the quantity of cabinets needed for this project.

1. Lighting contactors shall be housed in a separate cabinet. The contactor cabinet shall contain custom configured contactor modules for 20, 30, 60, and 100 amps, labeled to match field diagrams and electrical design. Manual On-Off-Auto selector switches shall be provided as hereinbefore described. Refer to the Drawings for specific contactor sizes.

2. As an option, the contactors may be located within the Lighting Control and Monitoring Cabinet provided there is adequate space. However, all the contactors per system must be located in a single cabinet.

B. The final complete cabinet(s) with all electrical components shall bear the UL label.

C. The cabinet(s) shall be designed and produced to meet the criteria noted in this document. The supplier shall be capable of producing a premium grade product, which meets the quality, fit and finish noted in this document. The use of CNC (Computer Numerical Control) equipment is preferred. The supplier's shop shall be approved to produce UL listed products.

D. The cabinet(s) and doors shall be constructed to meet NEMA 1 standards. The cabinets shall have ventilation as required for the lighting controls and monitoring equipment and contactors.

E. All materials shall be new.

F. Unless otherwise noted, cabinet(s) shall be fabricated from 5052-H32 sheet aluminum of at least 1/8-inch thick. Alternate materials may be considered.

G. All materials shall be corrosion resistant for extended life.

H. The cabinet(s) and doors shall be fabricated to plus or minus 10-thousandths of an inch tolerance for proper fit. All bending shall be done using a suitable break press.

I. Connecting hardware screws, bolts, washers, nuts, etc. shall be stainless steel. The screws shall be stainless steel pan-head machine screw type. No sheet metal or self-tapping screws shall be permitted.

J. Welding:

1. All exterior seams shall be of continuously welded construction. All welds shall be free of slag and spatter. All exterior welds shall be ground smooth.

2. The supplier shall have suitable credentials to weld aluminum and shall adhere to all applicable ANSI standards.

3. The supplier shall use a suitable welding process and materials.

K. Doors shall be designed for maximum strength and snug fit. It is the supplier's responsibility to design and fabricate the doors to the fit and finish required in this specification. Doors shall be fabricated out of a single sheet of aluminum and have wrap-around return for strength and fit.

L. All equipment mounted in the cabinet shall be mounted on an inner wall.

XIV. LIGHTING CONTROL SYSTEM EQUIPMENT LABELING

A. All products shall be labeled (inside) with the supplier's company name, model number, panel rating and the date of manufacture.

B. The supplier shall also provide adhesive Lamicoid or vinyl labels on the inside of each cabinet for each component. Each contactor and output circuit shall also be labeled in accordance with the lighting design.

C. All ID labels shall have ¼" to ½" high black characters on a white background.

D. All wiring shall be labeled with computer generated sleeve type wire markers.

Part 3 - Execution

I. LAYOUT

A. This Contractor shall layout all equipment and review locations with the Architect/Engineer and/or Owner prior to construction. Poles shall be laid out based on pole locations on the suppliers lighting layout drawing. Pole locations shall be set by using a metal tape to the exact locations shown on the drawings (+/- 2 feet).

II. POLE HANDLING AND ERECTION

A. Transportation, site handling and erection shall be performed by qualified personnel with equipment and methods that are in accordance with standard industry practices.

B. Prior to unloading the pole, shop drawings shall be reviewed to identify proper pick-up points for unloading, storage and erection procedures. A thru-hole shall be provided at the proper pick-up point for the purpose of inserting a steel bar to act as a stop to the cable choker when erecting the pole.

C. Web fabric slings (not chain or cable) shall be used to raise and set structural members. Protect equipment during installation to prevent corrosion.

D. Step bolts, safety cable and internal wiring may be installed while the pole is in a horizontal position on the ground. If the service platform/crossarms are to be attached prior to erection, the pole tip must be supported to prevent undesirable deflection.

E. Install poles and other structural units level, plumb and square. Orientation of the prestressed concrete pole base or the cast-in-place foundation anchor bolts in relation to the direction of the lighting must be checked carefully using the Manufacturer's drawings, contract drawings and specifications.

F. For base plate style poles, the steel shall not be installed until concrete has reached the specified 28-day strength. For direct bury prestressed concrete foundations the steel pole portion shall not be installed until backfill has reached 98% of the specified compaction all around the prestressed foundation as per ASTM D698.

G. Prestressed concrete poles shall be the direct embedment foundation.

H. After installation is complete, the Contractor shall plug with suitable semi- permanent material any alignment or installation aid or other unused holes or cavities in the poles to prevent them serving as harboring for insects and to prevent tampering. Material used shall be the same color as the pole.

III. SITE PROTECTION AND RESTORATION

A. Protect existing site, plantings, trees, pavements, facilities, structures, grounds, playing fields, and all other site amenities designated or intended to remain, temporarily or permanently, from damage during demolition or construction activities, including delivery of poles and equipment. Repair items damaged during demolition or construction activities to their original condition, or replace with new, by qualified personnel and technicians, at no additional cost to the Owner. Repairs, reinforcement or structural replacement shall be approved by the Architect and/or Owner.

B. Refer to Specification Section 02100 for additional requirements, if necessary.

IV. STORAGE

A. Poles and foundations may be stored on-site (for a short time period) if they do not impact the day-to-day operations of the facility. Poles and bases shall be placed on suitable supports.

B. Luminaires, platforms, crossarms, wiring, electrical enclosures and control equipment shall be stored off-site until they are ready for assembly and erection. On-site storage is permitted provided all items are stored in secure and DRY locations.

C. This Contractor is responsible for any damage or theft to any materials left on- site.

V. FOUNDATIONS

A. Foundations shall be the directly embedded pre-stressed concrete or cast-in- place concrete (directly embedded steel in ground is not acceptable). The foundation shall have suitable conduit entrance holes and wiring access hand holes and shall have a suitable wire way into the pole.

B. Top of cast-in-place concrete bases shall be trowel finished smooth and level with beveled edges. Top surface shall not vary by more than 1/8 inch in depth as measured across the widest surface.

C. All concrete shall be fully vibrated.

D. Reinforcing steel shall meet ASTM A615 and Grade 60.

E. Cast-in-place foundations anchor bolt projections must allow for the thickness of the base plate, nuts (including leveling nuts), and raking if required. Adjust leveling nuts before installing the pole. They should be in a horizontal plane.

F. Reinforcing steel in cast-in-place foundations must not be welded to the anchor bolts. Care must be taken not to disturb the position of the anchor bolts while pouring concrete.

G. Steel poles shall have grout in the void between pole base and foundation. Use approved non-shrinking or expanding concrete grout firmly packed in entire void space. Use a short piece of ½ inch diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

VI. POLE/FOUNDATION EXCAVATION

A. The Contractor may excavate by any means he prefers, insofar as these methods conform to these specifications. Holes shall be excavated with diameters not less than 8 inches greater than the largest dimension of the pole foundations being installed. Required depth of pole holes shall be as recommended by the pole manufacturer and the support assemblies Professional Engineer.

B. The bottom of the pole holes shall be on undisturbed earth. If a pole hole is excavated

to a depth greater than required, it shall be backfilled with specified crushed stone, placed in 6 inch layers, and thoroughly machine tamped to an approximate compaction of 95%.

C. All excavations must be free of loose soil and debris prior to foundation installation and concrete pour and backfill placement.

D. Backfill:

1. Prestressed concrete foundations shall include poured concrete backfill. Temporary casings or drillers slurry may be used to stabilize the excavation during installation. Casings must be removed during concrete backfill placement. Concrete backfill must be placed with a tremie when slurry or water is present within the excavation or when the free drop exceeds 6'-0".

2. Cast-in-place foundations backfill shall be Maryland Department of Transportation (MDOT) specification 21-A bluestone placed from the bottom of the pole hole to a distance of 18 inches below the top of the hole and topped with excavated soil. All backfill shall be placed in 6 inch layers and each layer shall be thoroughly tamped to an approximate compaction of 95%. The soil backfill shall be banked and tamped around the poles/foundations to a height of 12 inches above the finished grade.

E. Subject to the Owner's approval, excavated surplus material shall be uniformly spread at the site or removed and disposed of at this Contractor's expense. Care shall be taken that the spreading of surplus material does not result in the channeling of run-off water past pole locations.

VII. LIGHTNING PROTECTION/GROUNDING

A. All pole structures shall be equipped with lightning protection meeting NFPA 780 standards and as shown on the Drawings. Contractor shall furnish and install a ground rod at each pole structure. Ground rod shall not be less than 3/4 inches in diameter and 10 feet in length, with a minimum of 12 feet embedment and connected to the pole structure in an approved method.

1. Concrete poles shall have a #4 A.W.G. ground conductor connected from the ground rod to the copper tank ground cast into the pole.

2. Steel poles less than 75 feet in height above the finished grade shall have a #2 A.W.G. ground conductor connected from the ground rod to the ground lug welded inside the pole. Steel poles 75 feet or greater in height above the finished grade shall have a #2/0 A.W.G. ground conductor connected from the ground rod to the ground lug welded inside the pole.

B. Ground rod conductor connections shall be with exothermal welds.

VIII. IN-GROUND HANDHOLES

A. Excavation

1. Excavation for the handhole shall be approximately eight inches deeper than the depth of the handhole box. The bottom of the hole shall be on undisturbed earth. Provide eight to ten inches of gravel for drainage.

2. Box shall be placed in the excavated hole with the top level with the finished grade.

B. Backfill

1. Backfill around the box shall be with excavated soil placed in six-inch layers and each layer thoroughly tamped to approximate compaction of 95%.

IX. LIGHTING CONTROL SYSTEMS EQUIPMENT INSTALLATION

A. Lighting Control Panels

1. Before installing the Sports Field Lighting Control and Monitoring Systems equipment check all of the Drawings for possible conflict of space and adjust the location of the system's equipment to prevent such conflict with other items. Equipment locations shall closely follow the layouts shown on the Drawings, leaving sufficient space for installations of panelboards and/or other electrical equipment.

2. Equipment shall be securely mounted at locations shown on the Drawings. Construction shall be such that additional conduits can be added for future requirements.

3. The cabinets and enclosures shall be mounted and grounded in accordance with the NEC. This Contractor shall furnish all materials necessary for mounting the cabinets.

4. Lighting control equipment will generally be located adjacent to respective lighting panelboards. During the construction process, protect all interior components of each relay panel and each digital switch from dust and debris. Any damage done to electronic components due to non- protection shall be the sole responsibility of this Contractor.

B. Pull boxes and wireways may be used for ease of field wiring and trouble shooting. All wireways shall have removable covers.

C. Switches: Provide outlet boxes, single or multi-gang, as shown on the Drawings for the control switches. Provide cover plates for all switches.

D. Wiring:

1. All vertical wiring for the lighting control systems shall be installed by this Contractor in conduit and/or surface metal raceway as shown on the Drawings.

2. All horizontal wiring for the lighting control systems to be installed in areas without a ceiling or in areas without an accessible ceiling shall be installed by this Contractor in minimum ½ inch conduit.

3. All horizontal wiring for the lighting control systems shall be run at right angles to the building structure.

4. All wiring for the lighting control systems shall be furnished and installed by this Contractor as hereinbefore specified and as shown on the Drawings. All junction box covers shall be stenciled for distinct identification.

5. All low voltage wiring connections shall be made by this Contractor accordance to manufacturer recommendations. Cables shall be run free of splices from the equipment enclosures to the outlets.

6. All wiring shall be checked and tested by this Contractor to insure the system is free from grounds, opens, and shorts.

7. Do not mix low voltage and high voltage conductors; power limited and non-power limited in the same conduit.

8. Ensure low voltage conductors, conduits or control wires do not run parallel to current carrying conduits.

9. All control wiring shall be labeled in accordance with the schematic diagram.

E. Terminal Blocks:

1. Terminal blocks, fuses, relays, etc. shall be din-rail mounted.

2. Output wiring shall be connected via terminal blocks to accept field wiring.

3. Terminals for bonding conductors shall also be provided.

F. Installation and Set-up

1. Verify that conduit for line voltage wires enters the panel in line voltage areas and conduit for low voltage control wires enters the panel on low- voltage areas. Refer to manufacturer's plans and approved shop drawings for location of line and low-voltage areas. It is the responsibility of this Contractor to verify with the lighting control manufacturer all catalog information and specific product acceptability.

2. Unused openings in cabinets shall be effectively closed.

3. Lugs shall be suitable and listed for installation with the conductor being connected.

4. Neatly group, lace and rack wiring in cabinets. Conductor lengths shall be maintained to a minimum within the wiring gutter space, but long enough to allow for future changes within the cabinet without splicing. Conductors shall be arranged in a manner that avoids strain on the connecting lugs and maintain the required bending radius of conductors inside cabinets.

5. Follow the manufacturer's torque values to tighten lugs.

6. Follow manufacturer's instructions for installation and for all low voltage wiring.

G. Service and Support

1. Start Up: This Contractor shall contact the manufacturer at least 7 days before activation of the system. Manufacturer shall remotely connect into the lighting control system, run diagnostics and confirm system programming. This Contractor shall be available at the time to perform any corrections required by the manufacturer.

2. Telephone factory support shall be available at no additional cost to the Contractor or Owner both during and after the warranty period. Factory shall pre-program the lighting control system per plans and approved submittal, to the extent data is available. The specified manufacturer, at no added cost, shall provide additional remote programming via Web Access as required by the Contractor or Owner for the operational life of the system.

X. FIELD QUALITY CONTROL

A. Inspect each installation for damage. Replace damaged luminaires and components. All luminaires shall be cleaned and completely lamped and wired.

B. Before energizing the system, the following steps shall be taken:

1. Retighten connections to the manufacturer's torque specifications. Verify that required connections have been furnished.

2. Remove shipping blocks from component devices and panel interiors.

3. Inspect each installed unit for damage. Replace damaged components.

4. Remove debris from the panels and cabinets, wipe dust and dirt from all components, and repaint marred surfaces with touch-up paint to match the original finish.

C. After installation and connection of sports field lights to their permanent power supply, the Contractor shall verify supply voltages and currents at the disconnecting device in the electrical enclosure and at the main circuit breaker. Branch circuit and feeder voltage drop shall not exceed three (3) percent. Ensure that the three phases are balanced between phases at each support structure to minimize flicker. Measurements shall be taken phase to phase.

D. Prior to the Architect/Engineer's and/or Owner's final site visitation, and acceptance of each construction phase, this Contractor shall conduct a complete operating test of each system, including each device. The system shall test free from grounds, shorts, and other faults. All connections shall be thoroughly checked for mechanical and electrical connections. Replace or repair damaged and malfunctioning units, make necessary adjustments, and retest. Repeat procedure until all units operate properly.

E. This Contractor shall perform all tests in the presence of the Architect/Engineer and/or

Owner. This Contractor shall furnish all personnel and test instruments for use in the tests. Give advance notice of dates and times for field tests to the Architect/Engineer and Owner and coordinate a mutually agreed time and date. All equipment shall be demonstrated to operate in accordance with the requirements set forth in these Specifications and as shown on the Drawings.

F. Testing and Measuring of Field Illuminance

1. Contractor shall perform proof-of-performance field measurements and analysis for compliance with lighting requirements hereinbefore described in Part 1.04 LIGHTING PERFORMANCE. Initial footcandle readings for the sports lighting luminaires shall be taken after 100 hours of lamp operation. Testing shall not begin until the HID lamps have been operating for a minimum of one (1) hour and complete night time darkness.

2. Field measurements shall be taken on appropriate grid spacing test stations and at the appropriate spill-light and glare points test stations. Test stations shall be the points hereinbefore specified in the “Lighting Performance” section.

3. Ambient light levels shall be measured at the specified test stations with the facility luminaires turned off. Once the maximum spill-light readings have been recorded, subtract the ambient light readings from the respective footcandle readings at each test station to determine spill-light due to facility luminaires only.

4. Testing equipment for measuring footcandle levels shall be a Gossen Panlux meter or equal. Meter must show proof of calibration as required by its manufacturer.

5. After all photometric testing has been completed, a final report shall be provided to the Architect/Engineer and the Owner. This report should indicate footcandle levels taken on the playing field, spill-light locations (including and deducting ambient light levels at spill-light locations), candela levels for glare measurements at the spill-light locations, total number of hours on the system, average initial illumination as tested, CV and uniformity ratios. Report shall also include computer-generated values. Computer-generated values shall use Manufacturer’s lamp lumens that are adjusted to lamp age at time of field testing.

6. Correcting Non-Conformance – If, in the opinion of the Architect/Engineer and/or Owner, the actual performance levels and uniformity do not meet the requirements of the performance specifications and submitted information, the Contractor shall be liable to any of the following:

    a) Contractor shall, at his expense, provide and install any necessary additional luminaires and/or re-aim luminaires so that specified levels are achieved. If additional luminaires are installed the Contractor shall also either replace the existing poles to meet the new wind load (EPA) requirements or verify by certification by a licensed Professional Engineer registered in state of Maryland that the existing poles will withstand the additional wind loading.

b) Contactor shall remove the entire unacceptable lighting system and install a new lighting system to meet the specifications.

XI. WARRANTY AND MAINTENANCE REQUIREMENTS

A. This Contractor shall deliver the work in a first-class operating condition in every respect.

B. The Contractor/lighting system and controls system manufacturer shall warrant that the material, equipment, and workmanship furnished shall be entirely free from defects for a minimum 25-year Warranty Period based on 500 hours of use per year for diamond fields (baseball/softball) and 900 hours of use per year for rectangular fields. Any material, equipment, or workmanship in which defects may develop before or during the warranty period shall be repaired or replaced at the Contractor/Manufacturer's own expense. Refer to SECTION 01740 for the start of the warranty period.

C. In addition to the Warranty Provisions, the sports field lighting and controls system manufacturer shall provide a signed maintenance agreement covering the entire lighting and control systems for a minimum period of 25 years based on 500 hours of use per year for diamond fields (baseball/softball) and 900 hours of use per year for rectangular fields. The maintenance agreement shall guarantee light levels; lamp replacements; monitoring; communications; maintenance and control services; spill-light control, and structural integrity. During the maintenance period the manufacturer shall:

1. Maintain lighting levels within +/-10% of the maintained horizontal average illuminance level for the entire field.

2. Group-replace all lamps when they reach the end of their service life as specified by the lamp manufacturer. The sports field lighting and controls system manufacturer shall submit a re-lamping schedule for the maintenance period based on the lamp manufacturer's lamp lumen depreciation curve and hours of use per year.

3. Spot-replace individual lamps when 10% of the lamps are extinguished on the entire athletic field or more than one lamp is extinguished on any one pole.

4. All repairs shall be completed within seventy-two (72) hours of notification, unless otherwise approved by the Owner.

D. Manufacturer shall maintain specifically-funded financial reserves for this project to assure fulfillment of the warranty and maintenance for the full term. Warranty may exclude fuses, storm damage, vandalism, abuse and unauthorized repairs or alterations. Warranty may not exclude means and methods to access any part of the lighting and controls systems.

XII. OPERATING AND MAINTENANCE INSTRUCTIONS

A. At the completion of the installation, this Contractor shall furnish four (4) final sets of "as-built" drawings as well as manuals of instruction as to the proper operation and maintenance of the sports field lighting system and control system.

B. The “As-Built” documentation shall include wiring diagrams for the lighting control and monitoring systems. Diagrams must indicate exact mounting location of each system and their devices. This accurate “as built” shall indicate the loads controlled by each relay and contactor and the identification number for that relay and contactor, and placement of switches. Original shall be given to Owner, copies placed inside the door of each lighting control cabinet.

C. This Contractor shall also furnish the Architect/Engineer four (4) bound copies of complete operating and maintenance instruction manuals of the complete sports field lighting system and the sports field lighting control and monitoring system. These manuals shall include factory service manuals with complete parts lists, wiring and component schematics including circuit diagrams, programming forms with complete information and all other information necessary for proper operation, service, and maintenance of the systems.

XIII. TRAINING

A. This Contractor shall furnish the Owner’s officially designed representative(s) with a minimum of four (4) hours of on-the-job instructions in the operation, maintenance, and testing of the systems, using the factory operation manuals previously specified, for proper operation, maintenance and testing of the systems. The lighting controls supplier shall undertake all required set-up, programming, testing, commissioning and training of the Owner’s Representative as required for the proper operation of the lighting control and monitoring system.

B. This Contractor shall furnish four (4) hours of operating and programming training to the Owner’s operating staff to be scheduled at the Owner’s convenience during the warranty period.

C. All training specified herein shall be performed by a factory certified technician.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include the materials and equipment necessary for this Contractor to furnish and install a performance lighting control system(s), wiring devices and performance lighting instruments herein specified for the television studio. It shall also include the services of qualified field engineer/technicians regularly employed by the manufacturer of the system(s) who shall review the installation(s) to ensure its proper operation and provide Owner training.

B. The Television Studio Performance Lighting Systems and Controls shall be furnished by a factory authorized Theatrical Contractor/Distributor certified to design, program and service the systems. The Theatrical Contractor shall be responsible for coordination between the electrical installation and other trades installing theatrical equipment and for control terminations, system startup, system training, and warranty repair. A Theatrical Contractor is defined as a dealer who regularly engages in the sale and installation of theatrical supplies and equipment. The Theatrical Contractor/Distributor must show evidence of successfully furnishing theatrical systems specified for at least five (5) years.

C. This Contractor shall furnish and install all necessary equipment as hereinafter detailed for a complete and functional performance lighting control system(s) including the theatrical lighting instruments. Although not every component is called out in every detail, it shall be the responsibility of the manufacturer providing the system to assure that the intended function is furnished.

D. The system specified herein shall consist of a dimmer-per-circuit high density dimming system equipment panel, performance lighting control console, distribution equipment, performance lighting instruments, and all required interconnecting wiring.

E. This Contractor shall furnish and install in accordance with the lighting control manufacturer's instructions, all conduits, wiring, and outlet boxes required for the erection and operation of the complete system(s) as herein specified and as shown on the Drawings.

F. The performance lighting control system shall be supplied as a single integral unit with all dimmer modules, control circuits, circuit breakers, and the like factory wired. Field wiring shall consist of connecting input feeders, dimmer circuits, and remote control wiring to the distribution devices and control console.

G. It is the intention of this specification section that the entire Television Studio

performance lighting control system be available to all bidders and not “Packaged or Bundled” with any other lighting systems or equipment.

III. QUALITY ASSURANCE

A. The contractor shall furnish submittals for all components of the performance lighting and lighting control system(s) in accordance with SECTION 16010 of these Specifications. The submittals should include the manufacturers working drawings and shall include, but not be limited to the following:

1. Manufacturer's catalog data for all lighting instruments, equipment, and components that shall include all technical data to demonstrate conformance with these Specifications.

2. Complete physical drawings of all items of equipment showing dimensions, metal gauges, etc.

3. Complete load schedules which shall clearly indicate actual connected loads and control channel assignment (where applicable), cross- reference of internal equipment identifications to circuit numbers shown on the Drawings, and all other scheduled information which shall relate the equipment to the project requirements.

4. Complete internal and interconnection wiring diagrams showing number, size, and types of conductors between equipment and from equipment to loads, and feeder quantity and sizes.

B. The lighting control system equipment specified herein shall be the sole responsibility of a single manufacturer. The manufacturer shall have been producing theatrical lighting and SCR type lighting control systems for at least fifteen (15) years.

C. All work shall be in accordance with good engineering practices. All equipment for this system shall be listed by Underwriter's Laboratories, Inc. (UL), bear the UL label, and shall be installed in accordance with all requirements of the National Electrical Code (NEC), state and local codes, and these Specifications.

D. The entire performance lighting control system shall be completely factory assembled and tested under load conditions prior to shipment of the system.

IV. QUALIFICATIONS

A. The Contractor and the Theatrical Contractor/Distributor shall be required to furnish satisfactory proof of their competence as evidenced by successfully completed previous contracts where control equipment of this nature has been specified.

B. The Contractor is encouraged to visit the site, shall become familiar with the Drawings outlining this work, and shall become completely familiar with the various items of equipment being furnished under other Divisions of these Specifications related to this

work. The Contractor shall make all necessary investigations relative to the conditions that may be encountered on this project.

V. SPARE PARTS

A. This Contractor shall furnish to the Owner spare parts as follows. Spare parts shall be furnished prior to the installation of the system.

1. One (1) dual 2.4 kW dimmer module.

2. One (1) set of component level wiring schematics.

3. One (1) spare of each type solid-state control card (or circuit board) used in the dimming system equipment rack.

4. One (1) spare of each type dimmer control module (or circuit board) used in the dimming system equipment rack.

5. One (1) set of equipment software package.

B. This Contractor shall furnish to the Owner, at the completion of the project, 20% (minimum of two) spare lamps for each type and wattage of lamps used in the theatrical lighting instruments.

Part 2 - Products

I. MANUFACTURERS

A. The performance lighting control system(s) as shown on the Drawings and herein specified shall be as manufactured by ELECTRONICS DIVERSIFIED, INC. (EDI) as listed or the pre-approved equivalent as manufactured by ELECTRONIC THEATRE CONTROLS, INC. (ETC), LEHIGH ELECTRIC PRODUCTS CO. (LEHIGH) or STRAND LIGHTING, INC. which meets all of the requirements of these Specifications. The system shall utilize the manufacturer's standard products and components with modifications as required to meet the construction and performance requirements of this section.

B. The theatrical lighting instruments as shown on the drawings and herein specified shall be as manufactured by ALTMAN as listed or the equivalents as manufactured by ELECTRONIC THEATER CONTROLS, INC. (ETC), or STRAND LIGHTING, INC. which must meet all of the construction and performance requirements of these specifications.

II. DIMMING SYSTEM EQUIPMENT RACK

A. This Contractor shall furnish and install where shown on the Drawings, a performance lighting dimming system equipment rack. The rack shall be EDI "MX" Dimmer Rack System and shall consist of a wall mounted factory assembly constructed of tubular steel or steel angle frames and enclosed with code gauge metal panels. All rack

components shall be properly treated, primed and finished. Exterior surfaces shall be finely textured with scratch resistant, two-part polyurethane or equal. Removable cover panels shall be provided for each end and top of the dimmer bank to facilitate conduit terminations. Rack components shall be designed for easy removal and installation so that the dimming system equipment rack is completely open and empty during field wiring. Rear access to the rack for installation or servicing shall not be required. Racks shall be designed for front access to allow for wall mounting and side-by-side installation.

B. The dimming system equipment rack shall have factory wired provisions for a minimum of twenty-four (24) 20 amp plug-in dimmers. Dimmers shall be contained in a module. Each module shall house two (2) dimmers. The dimmer modules shall be sequentially numbered, labeled and addressed from top to bottom. No two physically consecutive dimmer modules shall be on the same phase. Guides shall be provided on the dimmer trays for ease of insertion and withdrawal of the dimmer modules without the use of tools. Positive means shall enable the rack and the dimmer module connectors to assure precise alignment of the module into power and signal connector blocks and to protect the connector pins from insertion damage. The dimmer module shall connect the high voltage output pins prior to the low voltage signal pins to ensure proper connections and to protect the module from arcing should control signals be activated during the insertion process. Connecting pins mating high and low voltage signals simultaneously shall not be accepted. All power and signal connections shall be factory wired and neatly dressed. Adequate space shall be provided for field wiring alongside factory installed wiring. Terminals shall be provided for multiplexed signal wires consisting of two (2) over-temperature wires and auxiliary wires as required by the manufacturer. All terminals shall be clearly marked and connectors and wiring shall be accessible from the front of the rack. The removal of any dimmer module from the rack shall not expose line or low voltage terminals or surfaces to the touch. Electrically live surfaces shall be not less than six (6) inches from the front of the rack with dimmer modules removed. Racks that require removable panels to access load, neutral or control terminations shall not be acceptable.

C. All control wiring shall conform to the recommended practices for DMX-512A E1.11 as published by the United States Institute for Theatre Technology (USITT) and the Entertainment Services and Technology Association (ESTA).

D. The rack shall be configured to accept mixed dimmer types and ratings throughout the rack.

E. Forced air cooling of the rack shall be provided by a low noise fan(s). Fan(s) shall be mounted in the dimming system equipment rack to maintain the temperature of all components at proper operating levels with all dimmers under full load. The fan(s) shall turn on whenever any dimmer in the system is activated. In the event of an over temperature condition, only the affected dimmer module(s) shall shut down and an LED indicator shall appear on the affected dimmer module(s) and shall not cause the entire rack to shut down. An automatic fan shut-off shall be furnished, activated when the control console is turned OFF, but shall remain ON during thermal shutdown of individual dimmer modules until the rack has cooled to an acceptable point.

F. The dimmer rack shall be supplied with a circuit breaker protected panel containing a 20A, 120VAC, 60 Hz, grounded duplex receptacle.

G. The dimmer rack shall be equipped with an illuminated LCD status beacon. The LCD status beacon shall display rack status and messages.

H. The dimmer rack shall be furnished complete with a full height lockable metal door containing an electrostatic air filter that shall be removable for easy cleaning and an engraved nameplate as herein before specified. The nameplate shall be lettered TELEVISION STUDIO LIGHTING DIMMING SYSTEM EQUIPMENT RACK.

I. The dimming system equipment rack shall be suitable for operation at 120/208 volt, three phase, four wire, sixty hertz, 200 amp, and have busing rated for 100% continuous duty, suitable lugs for a single point connection, a system minimum fault current rating of 22,000 AIC, and UL listed with appropriate factory applied labels.

III. DIMMER CONTROL MODULE

A. All control electronics shall be contained in a single plug-in control module mounted in the rack.

B. The control module shall contain rack status indicators to include, but not be limited to, the following LED user indicators:

1. DMX port “A” or “B” status.

2. Electrical phase “A”, “B”, or “C” is above or below safe operating voltage.

3. Dimmer rack has shutdown due to improper startup voltage.

4. Over-temperature protection has caused a dimmer to shut down.

C. Ambient temperature is above safe operating temperature.

D. Ambient temperature is below safe operating temperature.

1. Dimmer rack’s “service mode” is activated.

E. The control module shall respond to control changes in less than twenty-five (25) milliseconds. Dimmer outputs shall exhibit no oscillating or hunting for levels.

F. Dimmer output shall be regulated for incoming line voltages. The control module shall monitor and adjust each dimmer’s output to maintain a constant power to the load. Regulation shall maintain the desired output voltage for the entire operating range (90-140VAC) with the exception that the maximum output will be no greater that the line voltage minus dimmer insertion loss. There shall be no interaction between dimmers or any other equipment in the system. Line compensation shall be field adjustable on a

dimmer-by-dimmer basis to allow for varying cable length.

G. The control module shall include a minimum of two (2) optically isolated DMX512A inputs allowing overlapping or separation of any control level. Twenty- five hundred volts (2500V) of optical isolation shall be provided between the DMX512A inputs from a failed control module and shall protect the control module from failed DMX512A inputs. Systems that do not have optical isolation will not be acceptable.

H. The control module shall provide for a minimum of twelve (12) 0-10 volt analog inputs to allow for analog control of the rack. It shall be possible to assign each dimmer to any one of the twelve (12) analog inputs. The analog input shall not reduce the number of incoming DMX512A signals.

I. With the exception of the analog inputs, the control module shall be completely digital without employing any digital-to-analog de-multiplexing schemes or analog ramping circuits. The rack shall, in the event of signal loss, maintain the last level for a user programmable time period. Systems that do not include this feature will not be acceptable.

J. The control module shall contain diagnostic routines to allow the user to test and troubleshoot the system.

K. The control module shall include a system-wide panic circuit. Any dimmer or group of dimmers in the rack may be assigned proportionally to the panic circuit.

L. Each dimmer shall be capable of being assigned a specific address for each DMX512A input.

M. The control module shall be capable of recording backup looks. It shall be possible to program backup looks by any of the following methods: recording current dimmer levels (as set by the console or other remote programming device); entering dimmer levels on the control module directly via a handheld remote.

N. It shall be possible to have multiple backup looks active simultaneously with inputs operating on a highest take precedence basis.

O. Two (2) separate and distinct patches shall be available. Selection between the patches shall be possible from the remote-control keypad.

P. The control module shall include a single function service switch that shall allow the end user to bypass the control electronics configuration. When activated, the service switch shall drive all circuits to full output.

Q. The control module shall accommodate remote control devices via a multi-link network.

R. The control module shall include a port for connection of a remote-control keypad.

IV. REMOTE CONTROL KEYPAD

A. The system shall include a hand-held remote control keypad complete with cord for connecting to the dimmer control module and a LCD display for system configuration, testing, and diagnostics. The LCD shall also display rack status and messages.

B. The remote-control keypad shall include, but not be limited to, the following displays.

1. Dimmer display shall allow a dimmer or dimmers to be set at a level.

2. Backup display to program and activate system-wide backup looks.

3. Display information shall allow monitoring of system, rack, or dimmer status.

4. System information shall provide information about DMX outputs, panic circuits, backup looks, and system name.

5. Rack information shall provide information about rack voltage, starting addresses, ambient temperature, and rack type.

6. Dimmer information shall provide information about dimmer size, type, location, output levels, and control source. Setup display shall allow, but not be limited to, configuring of rack addresses, dimmer firing mode, and line compensation values.

C. The remote-control keypad shall be capable of activating all of the control module system functions. Systems that do not offer this feature will not be acceptable.

V. DIMMER MODULES

A. This Contractor shall furnish dimmer modules as part of the dimming system equipment rack. Dimmer modules shall be fully plug-in, factory-wired units designed to slide into the dimmer trays. No tools shall be required for module removal and insertion. Modules shall be of rugged, heavy-duty construction with all electrical and electronic components fully enclosed, all sides and top and bottom, by a formed aluminum chassis. Dimmer modules constructed of molded plastic for structural support are not equivalent and are not acceptable. Dimmer modules shall not have any protruding connector pins subject to physical damage when the module is not inserted. Dimmer modules shall be UL listed devices and shall carry the appropriate label. The front panel of each dimmer module shall be factory marked with the manufacturer's name, model number, quantity and capacity of dimmers, and power line voltage and frequency.

B. Each dimmer module shall contain a circuit breaker for each circuit, a solid state switching module, associated toroidal filters, status indicators, and power and control connections.

C. Each dimmer module shall use a solid-state module (SSM) consisting of two (2) silicon-controlled rectifiers (SCRs) in an inverse parallel configuration and all required gating circuitry on the high voltage side of an integral, opto-coupled control voltage isolator. The SSM shall be thermally protected, independent of the control module. SSM shall provide minimum of 10,000V RMS isolation between the line and control sides of the device. The full load of the circuit shall be carried and controlled solely by the silicon-controlled rectifiers. Dimmers employing triacs shall not be acceptable.

D. Dimmer modules shall be 2.4kW and shall have a minimum capacity of 40 amps, with a rating of 500 amps peak single cycle surge current and 600 volt transient capacity. Dimmer modules shall be available to accommodate incandescent, low voltage, and non-incandescent loads.

E. Each dimmer module shall have an integral inductive high performance toroidal copper-wound choke filter mounted within the plug-in module. The choke filter shall be designed to reduce the rate of current rise resulting from the SCR switching in order to: limit objectionable harmonics; reduce acoustical noise in the dimmer load which would create lamp filament noise in the output circuit; limit conducted radio frequency interference on the AC line and on the load wires; and isolate the dimmer from the AC line to prevent interaction with other dimmers. Dimmers with "E-I" or double "e" filters shall not be acceptable.

F. Each dimmer shall be protected by a fully magnetic single pole, 20 amp, one hundred percent (100%) rated circuit breaker listed at 10,000 amps interruptible current mounted on the face plate of the dimmer. The breaker shall be used as a dimmer disconnect and shall be a UL listed device. Under overload conditions, the circuit breaker shall disconnect power to the dimmer module before damage can be done to the power devices. The trip current shall not be affected by ambient temperature within the operational specifications of the system.

G. Current limiting feedback techniques shall not be acceptable as a means of protecting a main power device. Under no circumstances shall dimmers allowing continued operation with a load substantially in excess of the rated capacity be acceptable. The protective devices shall have a maximum "must trip" rating of one hundred twenty five percent (125%) of the rated capacity.

H. The rise time rating for a 2.4kW dimmer shall be as noted in the manufacturer’s oscilloscope data, but in no case less than five hundred (500) microseconds (µS) measured at ninety (90) degrees conducted angle from ten percent (10%) to ninety percent (90%) of the output wave form with the dimmer at fifty percent (50%). Alternate manufacturers must also supply either high performance chokes or certified test data ensuring compliance. The manufacturer shall furnish a documented photograph of the scope measured rise time with the submittals.

I. The high-performance dimmer (500 µS) shall have an insertion voltage drop of no more than 5.5 volts RMS at the maximum rated load with 120 volts input.

J. The dimmer module shall be designed to operate on a 100 to 140-volt AC line at 50 to 60 Hz. Adequate heat sinking shall be provided so that all components remain at a safe operating temperature with the dimmer properly installed in the dimming system equipment rack.

K. The dimmer module shall be capable of "hot patching" cold incandescent loads up to its full rated capacity without malfunction with the control signal ON.

L. Dimmers shall maintain output RMS voltage within two percent (2%) with changes in load from 10 watts to full rated load at any point on the dimming curve.

M. Switch-on versus switch-off response time shall be within 0.1 seconds for all loads.

N. The output RMS voltage versus control console setting shall follow the "square law dimmer curve". Dimmer curve shall be stable without the need for curve adjustment.

O. The power efficiency of the dimmer shall be a minimum of ninety five percent (95%) at full load. Power consumption shall not exceed 0.1 watt per dimmer.

P. Dimmer modules of the same capacity shall be interchangeable. Connectors and receptacles of modules of different capacity shall be polarized so that modules of different capacity cannot be interchanged.

Q. This Contractor shall furnish and install in the dimmer rack, 2.4 kW dimmers in the quantity required for all of the performance lighting indicated on the Drawings plus the spares required elsewhere in this Specifications. Dimmers shall be EDI "MX" SCR Dimmer Modules or approved equal.

VI. PERFORMANCE LIGHTING CONTROL CONSOLE

A. This Contractor shall furnish and install a Performance Lighting Control Console, where shown on the Drawings. The console shall be “Lite-24" as manufactured by ELECTRONICS DIVERSIFIED, INC. (EDI) as listed and described herein, or the pre-approved equivalent as manufactured by ELECTRONIC THEATRE CONTROLS, INC. (ETC), LEHIGH or STRAND LIGHTING, INC. which must meet all of the requirements of these Specifications. Other console manufacturers may be acceptable provided the console is pre-approved in accordance with specification Section 16010.

B. A micro-processor based controller specifically designed for the live performance market. The Console shall be modular by design and have the capacity to address 12 or 24 control channels in a two-scene preset configuration. The standard communication protocol shall be USITT DMX-512 and Analog 0-10 VDC at 5mA.

C. The Console shall be housed in a heavy-duty aluminum enclosure substantially framed for portable use with a sloped front control surface clearly marked for operation. All nomenclature shall be silk-screened for high contrast low light-level viewing. All control connectors integrated into the chassis shall be of locking type to insure proper

operation.

D. The Console program shall be secured in a non-volatile read only memory. The program operation shall not be dependent upon any peripheral device for operation. Recorded memory shall be protected by a ten-year lithium battery.

E. The Console shall provide, but not be limited to the following as standard features:

1. Forty-eight (48) channel faders - Individual slider controls, arranged in two rows of 24, with individual control for manual intensity selection.

2. Bump Buttons, assigned to individual channel and submaster controllers for instant output when touched. Solo, On and Off output is selected and controlled by the bump mode selector and intensity fader. LED status indicators mimic the assigned channel output level.

3. Split Dipless Cross faders, allowing operator control of the two manual preset scenes with separate fader and time controls for each scene. An LED array shall indicate the status of the fader at all times.

4. Grand Master and Blackout Switch: All channel, submaster, effect and fader outputs shall be assigned and proportionally controlled by this potentiometer and switch.

5. Submasters: Overlapping, pile-on, programmable submasters, with bump buttons for individual control of recorded outputs. Up to three (3) pages of individual submaster outputs can be recorded in the submaster memories.

6. Effect Controls: Allow access to special chase effects. Step/Hold key accesses step mode while order of bump button input determines the order of the steps. Individual tare and level controls allows variable playback options. Effects direction offers forward, reverse and bounce options.

7. Program Key: Allows access to record functions for submaster and effects memories.

8. Power Indicator: Confirms power is connected and switched On for operation.

F. The Console shall provide, but not be limited to the following operating functions:

1. The level setting capacity shall be accessed through the linear potentiometers available on the channel sliders.

2. The channel playback capacity shall be accessed through the timed Cross Faders which shall execute the individual levels set on the channel modules.

3. The Submaster capacity shall be accessed through the Program Key. Any fader output can be captured for storage on the submaster by selecting the

submaster page and number for the record and by pressing and holding the Program Key and pressing the bump button under the submaster to be recorded.

4. The Effects capacity shall be accessed by pressing the Program Key to access the effect. Select the output to be included in the effect step. Capture the by step pressing the Step/Hold key. Each successive step is created in this method. Up to 96 steps shall be available for each Effect. The direction, level and rate of the Effect may be altered at any time. Effects interact with memories on a highest takes precedence basis.

5. Soft Pack: Up to 192 individual DMX-512 dimmers may be accessed. Any dimmer may be assigned to any channel.

G. Low voltage control wiring shall be per system manufacturer recommendations and included in the shop drawing submittals.

H. The Console shall house an integral power supply which shall regulate power within plus or minus 1% of incoming line voltage between 105 and 125 VAC. The console shall have the capacity to operate on 120 VAC, 60 Hz. The power consumption shall not be greater than 1 amp.

VII. PERFORMANCE LIGHTING CONTROL RECEPTACLE STATIONS

A. Remote Control Connector (RCC) stations for control consoles shall be provided at locations shown on the drawings. The RCC's shall be the five (5) pin XLR type receptacle with cover plate, fitted with twelve (12) inch labeled leads. The leads shall be labeled to correspond to the terminals of the dimmer bank. The RCC shall be installed in a standard flush or surface mounted outlet box as shown on the drawings. The remote-control connector shall be EDI Model No. RCC/5XLR or approved equal.

B. This Contractor shall provide two (2) matching twenty-five (25) foot long control cables, each with USITT standard five (5) pin DMX male and female connectors.

VIII. ELECTRICAL DISTRIBUTION EQUIPMENT

A. All distribution equipment shall be furnished by the manufacturer of the dimming equipment. Hanging and support hardware shall be furnished and installed under SECTION 11064 "THEATRE AND STAGE EQUIPMENT – RIGGING SYSTEMS".

B. This Contractor shall furnish and install plug-in boxes where shown on the Drawings as follows:

1. The lighting plug-in boxes shall comply with the requirements specified herein and shall be of the type specifically recognized, manufactured, and listed for this purpose. Each box shall be of sixteen (16) gauge steel with two (2) sets of knockouts on each side. Female receptacles shall be three pole, 20 amp,

grounded stage-pin (GSP) connector type attached to twenty-four (24) inch long rubber covered cable pigtails. Exterior finish shall be baked flat black enamel.

2. The lighting plug-in boxes shall be three or four-gang suitable for pipe mounting, supplied with a malleable iron clamp to grip up to a two (2) inch ID pipe, with exact configuration, pigtails, and grounded stage-pin receptacles as noted on the Drawings. The entire plug-in box shall be UL listed. The lighting plug-in box shall be the EDI Model No. PB-4133 (three-gang) or PB-4143 (four-gang) or approved equal.

IX. THEATRICAL LIGHTING INSTRUMENT PACKAGE

A. Theatrical lighting instruments manufactured by ALTMAN are specified herein to provide a basis of quality. Other acceptable manufacturers are ETC and STRAND LIGHTING, INC.

B. Theatrical lighting instruments shall be capable of performing with tungsten halogen lamps as indicated herein with proper heat sink cooling. Phenolic materials shall be employed on the fixtures in order to protect the operator from potential burns.

C. Each theatrical lighting instrument shall be supplied with a malleable iron clamp to grip up to a two (2) inch ID pipe, a fixture yoke with locking clutch handle, and three (3) foot long SF2 leads in a fiberglass sleeve.

D. Minimum performance criterion for all theatrical lighting instruments shall be as herein specified. Each instrument shall be furnished with a three pole, grounded stage-pin (GSP) connector and safety cable. UL listing is required on all theatrical lighting instruments.

E. Scoop ellipsoidal reflector floodlights (SERF):

1. The SERF shall be a 14-inch scoop ellipsoidal reflector floodlight with a medium prefocus socket designed to accept 500 to 1,000-watt Tungsten Halogen lamps. The socket shall be mounted in a spun aluminum housing to reduce heat buildup and to properly align the lamp in the reflector. The interior reflector surface shall be finished in a matte Alzak aluminum process for maximum illumination uniformity. A crank focus handle shall be provided to allow travel of the socket and lamp assembly along the center axis of the reflector for beam adjustment form spot to flood focus. An integral rotating color frame, closed on three sides, shall be supplied for mounting of the color/diffuser frame supplied with the unit. Re-lamping shall be accomplished by unseating the lamp from the medium prefocus base lampholder. Re-lamping shall be accomplished without disturbing the prefocused lamp alignment. The fixture shall have a baked black finish using an electrostatic application process.

2. Performance requirements for the variable focus 14” scoop units shall be as follows based on a 1,000 watt EGK lamp: The light output of the luminaire shall have a variable beam angle for from 32° to 70° and a variable field angle of

from 84° to 108° and shall produce 444 footcandles at centerbeam in spot and 156 footcandles at centerbeam in flood with an EGK lamp at rated lumens at a distance of 7.5 feet. The luminaire shall be UL listed and labeled for use with up to a 1,000-watt lamp.

3. This Contractor shall furnish total of five (5) fourteen (14) inch scoop variable focus SERS, each with a color/diffuser frame, safety chain and a 1,000 watt EGK lamp. The theatrical lighting instruments shall be ALTMAN catalog No. 160 or approved equal.

F. Fresnel Spotlights:

1. The instrument shall be a variable focus fresnel spotlight designed to accommodate a tungsten-halogen prefocus lamp up to 1,000 watts. The socket shall be mounted on an adjustable burner in front of a spherical specular high aluminum reflector. The instrument shall be provided with a heat resisting six (6) inch diameter molded high quality heat resistant borosilicate glass lens retained by a minimum of three (3) molded plastic stand-off pieces. These stand-off pieces shall allow air flow around the lens for additional ventilation of lens and color media.

2. The socket and burner assembly shall be readily moveable from spot to flood focus by means of a thermally insulated sweep arm. Focus position shall be indicated by a calibrated label. Lamp and reflector access shall be through a hinged front door. The front door assembly shall also house a positive lock for a barndoor and color frame.

3. Performance requirements for the six (6) inch fresnels shall be as follows based on a 1,000 watt BTR lamp: The light output of the luminaire shall have a field angle from 12.2 degrees to 73.8 degrees and shall produce one hundred ninety-nine (199) footcandles at center beam in spot focus and fifty-three (53) footcandles at center beam in flood focus at a distance of fifteen (15) feet at rated lamp lumens.

4. This Contractor shall furnish a total of eight (8) six (6) inch fresnel spotlights each with a color frame, four-way barndoor, safety chain, and 1,000 BTR lamp. The theatrical lighting instrument shall be ALTMAN Catalog No. 1KAF-MEPF or approved equal.

Part 3 - Execution

I. INSTALLATION

A. All wiring for lighting and control system shall be run in conduit as hereinbefore specified. All junction box covers shall be identified as hereinbefore specified. All conduits, device mounting boxes, junction boxes, and enclosures shall be securely fastened with appropriate fittings to insure positive ground throughout the entire system.

B. This Contractor shall furnish and install all wiring and make all final connections as indicated in the system manufacturer's shop drawings and standard installation documents. Splices for dimming circuits shall be made only in junction boxes.

C. All wiring shall be checked and tested by this Contractor to ensure the system is free from grounds, opens, and shorts.

D. All work shall be under the supervision of a field engineering technician, accredited by the system manufacturer. It shall be the responsibility of this technician to check and inspect the installation to the Owner's and Architect/Engineer's satisfaction. This technician shall also provide a minimum of four (4) hours of training for the Owner's operating personnel on the proper operation and maintenance of the lighting control system equipment.

II. OPERATING AND MAINTENANCE INSTRUCTIONS

A. At the completion of the installation, the manufacturer shall furnish four (4) final sets of "as-built" drawings as well as manuals of instruction as to the proper operation and maintenance of the lighting control system. "As built" drawings shall include all field modifications. Formal turn-on and instruction shall be provided to the Owner's officially designated representative within fourteen (14) days of a written request by the Owner.

B. This Contractor shall furnish the Owner's officially designated representative(s) with a minimum of three (3) hours of on-the-job instructions in the operation, maintenance, and diagnostic testing of the system. (This shall not be part of the system turn-on specified above.) This Contractor shall also furnish the Architect/Engineer four (4) bound copies of complete operating and maintenance instruction manuals of the lighting control system including circuit diagrams and all other information necessary for proper operation and service maintenance.

III. SYSTEM TEST

A. This Contractor shall conduct an operating test of the complete system. The system shall test free from grounds, shorts, and other faults. All connections shall be thoroughly checked for mechanical and electrical connections. All lighting control system equipment shall be demonstrated to operate in accordance with the requirements set forth in these Specifications and as shown on the Drawings.

B. This Contractor shall perform all tests in the presence of the Architect/Engineer. This Contractor shall furnish all personnel and test instruments for use in the test.

IV. WARRANTY

A. This Contractor shall deliver the work in a first-class operating condition in every respect.

B. This Contractor shall warrant that the material, equipment, and workmanship furnished

shall be entirely free from defects. Any material, equipment, or workmanship in which defects may develop before or during the warranty period shall be repaired or replaced at the Contractor's own expense. Refer to SECTION 01740 for the start of the warranty period. The Contractor shall further warrant that all material, equipment, and workmanship used in the installation, but not specifically mentioned in the Drawings and Specifications, is the best of their respective kinds and that the construction and installation was performed in accordance with the best accepted standard practices in all details.

C. All materials used shall be new and of good quality conforming to these specifications and the successfully reviewed submittals. Any material not successfully reviewed by the Architect/Engineer that is incorporated in the work, used or delivered to the site, shall be immediately removed upon the order of the Owner or Architect/Engineer and replaced to the satisfaction of the Architect/Engineer at this Contractor's expense.

D. It shall be this Contractor’s responsibility to include costs incurred in other trades for any work disarranged by such replacements described above. This will include replacement of work and damaged equipment during the progress of construction.

E. The lighting control system manufacturer shall be prepared to offer a service contract for the maintenance of the system after the warranty period.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include furnishing and installing exterior/security light-emitting diode (LED) luminaires complete as shown on Drawings, as described in the “Luminaires (Lighting Fixture) Schedule”, and as herein specified.

III. QUALITY ASSURANCE

A. This contractor shall provide luminaires that are of a manufacturer engaged in the production of luminaires that are equal in material, design and workmanship. The manufacturer’s luminaire shall have been in satisfactory commercial or industrial use for a minimum of three (3) years. The manufacturer’s luminaire shall have been available on the commercial market during the three (3) year period.

B. Exterior/security LED luminaires shall meet requirements of the National Electrical Code (NEC), state and local codes including Prince George’s County’s Outdoor Lighting Standards and these Specifications.

C. The luminaires shall be listed by Underwriters Laboratories, Inc. (UL) or listed by a nationally recognized testing laboratory acceptable to Prince George’s County (DoE).

D. Submittals are required in accordance with SECTION 260500 of these specifications.

E. In addition to the submittal requirements of Section 260500, submittals shall include but not be limited to the following:

1. Complete point-by-point photometric footcandle calculations of the parking lots on a scaled plan(s) (scaled to match the electrical site plan). The scaled plan must include points thirty (30) feet beyond the property lines. The calculations must include contributions from the building mounted luminaires and the pole mounted site luminaires.

2. Calculations must be based on “one (1) footcandle minimum maintained” with no more than 0.5 footcandles at the property line with a maximum of 0.01 footcandles ten (10) feet beyond the property line and a “light loss factor” (LLF) of 0.85. Luminaire photometry shall be designed using the I.E.S.N.A. LM-79-08 absolute photometric principles for LED lighting. The 0.5 footcandles maximum at the property line(s) and 0.01 footcandles ten (10) feet beyond the property line(s) must not be compromised.

3. The exact quantities, locations, and I.E.S.N.A. photometric distribution types of pole mounted luminaries, may differ from the original basis of design layout, but

the required footcandle levels must be maintained. Should the luminaire manufacturer require additional luminaires to achieve the stated footcandle levels and/or require additional branch circuit wiring, supports, poles, etc., in conjunction with these additional luminaires, shall not cause additional expense to the Owner.

4. The Architect/Engineer may require changes to the submitted point-by- point photometric plans, if in their opinion the plans do not meet the requirements of this project or do to conflicts with other site issues not addressed in the submittal.

F. Precast concrete pole base foundations may be used in lieu of the cast-in-place concrete foundations shown on the Drawings. If precast bases are used, submittals shall be provided and shall include but not be limited to the following:

1. Provide pole base foundation design drawings signed and sealed by a Professional Engineer registered in the state of Maryland. Foundation drawings shall indicate the design criteria, assumptions, codes, standards, and all foundation reaction forces and moments. Foundation drawings shall indicate the design criteria allowable soils bearing pressures, codes, standards, all foundation reaction forces and moments, construction specifications, materials, and specific installation requirements such as shoring or de-watering. For the purpose of this bid, the Contractor shall assume the following type of sub-grade material specified in the current adopted edition of the International Building Code, Section 1804, Table 1804-2 – Allowable Foundation and Lateral Pressure:

a) Soils – Class 5 (clay and sandy clay)

IV. DESCRIPTION

A. This Contractor shall furnish and install LED luminaires complete with proper reflectors, diffusers, louvers, glassware, concrete bases, gaskets, shims, wiring, control, conduit, hardware, photocontrols, and other appropriate devices and parts for a complete exterior weatherproof lighting installation. Adjustable luminaires shall be aimed as directed by the Architect/Engineer. Each luminaire shall be complete with prewired integral drivers and optical (LED) assemblies.

B. Luminaires that require remote mounting of any components needed for its operation, such as drivers, or light engine electronics are not permitted. All components needed to make the luminaire operational shall be integral to the fixture housing.

C. Luminaires shall have a minimum IP rating of IP65 or IP66.

V. WARRANTY

A. This Contractor shall deliver the work described herein in a first class operating condition in every respect. This Contractor shall also warrant that the material and workmanship shall be entirely free from defects. Any materials, equipment, or workmanship in which defects may develop before or during the warranty period shall

be repaired or replaced at the Contractors own expense. Refer to Division 1 for the start of the warranty period. The contractor shall further warrant that all material, equipment, and workmanship used in the installation, but not specifically mentioned in the Drawings and Specifications, is the best of their respective kinds and that the construction and installation was performed in accordance with the best accepted standard practices in all details.

B. All luminaires shall have a minimum five (5) year factory warranty for defective or non-starting power supply units (driver), and LED source assemblies, which includes, but not limited to: LED package, LED arrays, LED modules, LED die, encapsulate, and phosphor.

Part 2 - Products

I. MATERIALS AND COMPONENTS

A. Exterior/security LED luminaires supplied shall be complete with the proper reflectors, diffusers, house side shields, louvers, glassware, gaskets, pole arms, collars, shims, wiring, control, conduit, hardware, drivers, photocontrols, and other appropriate devices, parts and accessories to be properly installed for an exterior weatherproof lighting installation.

II. POLES AND STANDARDS

A. Poles for LED luminaires shall be aluminum or as indicated on the Drawings with factory finish as shown in the "Luminaire (Lighting Fixture) Schedule". Aluminum poles shall be factory wrapped with heavy weatherproof paper for protection during handling and shipping.

B. This Contractor shall furnish hot-dipped galvanized anchor bolts, templates, ground rods, conduit elbows, and base information, etc., for the installation of concrete bases as detailed on the Drawings.

C. Poles shall be of the height and with brackets, etc. as indicated in the "Luminaire (Lighting Fixture) Schedule".

D. All aluminum poles shall be seamless with all edges and parts factory polished and ground to a smooth congruous finish.

E. Poles greater than twenty (20) feet in length shall be complete with vibration dampers installed.

III. POWER SUPPLY UNIT (DRIVERS)

A. Luminaires shall be equipped with an LED driver(s) that accepts the voltage as indicated on the "Luminaire (Lighting Fixture) Schedule". Individual driver(s) shall be replaceable.

B. Driver(s) shall be UL8750 class 2 listed for their intended purpose.

C. Individual driver(s) shall be equipped with surge protection (6kV minimum for building mounted units and 10kV minimum for pole mounted units) in accordance with IEEE/ANSI C62.4.1 and shall be rated for a category “C” environment.

D. Driver(s) shall have a minimum efficiency of 85%.

E. Driver(s) shall reliably start at minimum ambient temperatures from -40 deg. C to 40 deg. C with THD of <=20%.

F. Drivers shall deliver full-range dimming from 0-10V control signal.

IV. LED LIGHT SOURCE (LIGHT ENGINE)

A. All LED light engine(s) shall be set to achieve IES, Type III, Type IV or Type V distribution as shown on the "Luminaire (Lighting Fixture) Schedule". Individual light engine(s) shall be replaceable

B. LED light engine(s) shall have a minimum lifetime of 50,000+ hours at 40deg.C and shall have a minimum efficacy of 80 lumens per watt.

C. All LED’s shall be installed with 0 lumens above 90° up from nadir (full cut-off) performance.

D. LED dies shall be tested in accordance with I.E.S.N.A. LM-80-08 standards.

E. Thermal management shall be passive by design and shall consist of heat sinks with no fans, pumps, or liquids.

V. DIMMING CONTROLS

A. Provide, in addition to the lighting control system, after hours dimming controls which reduces light levels to approximately 50% of full lumen output at a predetermined time. Controls shall be designed to fail to the “OFF” position. Dimming controls shall be compatible with the lighting control system. Refer to specification section 16505 or 16505A and details for lighting control system information.

VI. SPARE PARTS

A. The Contractor shall furnish to the Owner at the completion of the project, a minimum of 20% (minimum of 4) spare LED driver assemblies. LED drivers shall be turned over to the Owner representative in their manufacturer’s protective packaging. LED drivers not in their protective packaging will not be acceptable.

B. The Contractor shall furnish to the Owner at the completion of the project, a minimum of 20% (minimum of 4) spare LED light engine assemblies. LED light engines shall be turned over to the Owner representative in their manufacturer’s protective packaging. LED light engines not in their protective packaging will not be acceptable.

VII. FOUNDATIONS

A. Pole base foundations shall be cast-in-place as detailed on the Drawings and as specified herein.

B. Contractor may at his option use precast concrete base foundations in lieu of the cast-in-place foundations.

1. Precast concrete foundations shall be designed and fabricated by an experienced and acceptable precast concrete manufacturer. The manufacturer shall have been regularly and continuously engaged in the manufacture of precast concrete units for at least 10 years. In addition, the manufacturer shall employ a Professional Engineer registered in the state of Maryland.

2. The precast concrete units shall be designed to withstand design load conditions in accordance with the applicable industry design standards. Design must also consider stress induced during handling, shipping, and installation in order to avoid product cracking or other handling damage. Design loads for precast concrete units shall be indicated on the shop drawings, and designed by a licensed Professional Engineer registered in the state of Maryland.

Part 3 - Execution

I. INSTALLATION

A. The exterior/security LED luminaires shall be installed as shown on the Drawings and in accordance with the manufacturer's recommendations.

II. POLE LAYOUT

A. This Contractor shall layout all equipment and review locations with the Architect/Engineer and/or Owner prior to construction. Pole locations shall be set by using a metal tape to the exact locations shown on the Drawings.

III. POLE HANDLING AND ERECTION

A. Transportation, site handling and erection shall be performed by qualified personnel with equipment and methods that are in accordance with standard industry practices.

B. Prior to unloading the pole, shop drawings shall be reviewed to identify proper pick-up points for unloading, storage and erection procedures. A thru-hole shall be provided at the proper pick-up point for the purpose of inserting a steel bar to act as a stop to the cable choker when erecting the pole.

C. Web fabric slings (not chain or cable) shall be used to raise and set structural members. Protect equipment during installation to prevent corrosion.

D. Install poles and other structural units level, plumb and square. Orientation of the cast-in-place foundation anchor bolts in relation to the direction of the lighting must be checked carefully using the manufacturer’s drawings, contract drawings and specifications.

E. Pole steel base plates shall not be installed until concrete has reached the specified 28-day strength.

F. After installation is complete, the Contractor shall plug with suitable semi- permanent material any alignment or installation aid or other unused holes or cavities in the poles to prevent them serving as harboring for insects and to prevent tampering. Material used shall be the same color as the pole.

IV. SITE PROTECTION AND RESTORATION

A. Protect existing site, plantings, trees, pavements, facilities, structures, grounds, playing fields, and all other site amenities designated or intended to remain, temporarily or permanently, from damage during demolition or construction activities, including delivery of poles and equipment. Repair items damaged during demolition or construction activities to their original condition, or replace with new, by qualified personnel and technicians, at no additional cost to the Owner. Repairs, reinforcement or structural replacement shall be approved by the Architect and/or Owner.

B. Refer to Specification Section 02100 for additional requirements if necessary.

V. STORAGE

A. Poles and precast bases may be stored on-site (for a short time period) if they do not impact the day-to-day operations of the facility. Poles and bases shall be placed on suitable supports.

B. Luminaires, wiring, control equipment, etc. shall be stored off-site until they are ready for assembly and erection. On-site storage is permitted provided all items are stored in secure and DRY locations.

C. This Contractor is responsible for any damage or theft to any materials left on- site.

VI. FOUNDATIONS – CAST-IN-PLACE CONCRETE

A. Foundations shall be poured in place concrete. Concrete foundations shall be constructed of not less than 3,000 psi.

1. The steel reinforcement within the concrete shall be protected from slippage and exposure to oxidation through voids in the concrete or exposure of the steel through porous concrete material. Provide cover as specified in ACI-318.

B. All exposed areas of concrete bases shall be trowel finished smooth and level with beveled edges. Top surface shall not vary by more than 1/8 inch in depth as measured across the widest surface. Concrete base forms leaving any imperfections shall be ground down to have a smooth finish. Concrete bases shall be finished to remove all concrete form imperfections. Refer to Specification Section 16010.

C. All concrete shall be fully vibrated.

D. Reinforcing steel shall meet ASTM A615 and Grade 60.

E. Cast-in-place foundations anchor bolt projections must allow for the thickness of the base plate, nuts (including leveling nuts), and raking if required. Adjust leveling nuts before installing the pole. They should be in a horizontal plane.

F. Reinforcing steel in cast-in-place foundations must not be welded to the anchor bolts. Care must be taken not to disturb the position of the anchor bolts while pouring concrete.

G. Orientation of the foundation anchor bolts in relation to the direction of the lighting must be checked carefully using the manufacturer's drawings, contract drawings and specifications.

VII. FOUNDATIONS – PRECAST CONCRETE

A. The installation Contractor shall be responsible for ensuring that the subgrade is compacted to 95% of ASTM D558 density. The subgrade shall be a minimum of six (6) inches in depth.

B. Precast concrete units shall be: installed in accordance with the precast concrete producers installation instructions for direct embedment; installed to the lines and grades shown on the Drawings; be lifted by suitable lifting devices at points provided by the precast concrete producer; in accordance with applicable industry standards.

1. The precast concrete producer shall provide installation instructions.

2. Backfilling shall be done as soon as possible after the unit has been set in place.

C. Orientation of the foundation anchor bolts in relation to the direction of the lighting must be checked carefully using the manufacturer's drawings, contract drawings and specifications before placement of precast foundations into the ground.

VIII. POLE/FOUNDATION EXCAVATION

A. The Contractor may excavate by any means he prefers, insofar as these methods conform to these specifications. Holes shall be excavated with diameters not less than 8 inches greater than the largest dimension of the pole foundations being installed. Depth of pole holes shall be as detailed on the Drawings for cast-in-place foundations or as required for precast direct embedment units.

B. The bottom of the pole holes shall be on undisturbed earth. If a pole hole is excavated to a depth greater than required, it shall be backfilled with specified crushed stone, placed in 6 inch layers, and thoroughly machine tamped to an approximate compaction of 95%.

C. Backfill

1. The backfill for poles and foundations shall be Maryland Department of

Transportation (MDOT) specification 21-A bluestone placed from the bottom of the pole hole to a distance of 18 inches below the top of the hole and topped with excavated soil. All backfill shall be placed in 6 inch layers and each layer shall be thoroughly tamped to an approximate compaction of 95%.

2. Subject to the Owner's approval, surplus material shall be uniformly spread at the site or removed and disposed of at this Contractor's expense. Care shall be taken that the spreading of surplus material does not result in the channeling of run-off water past pole locations.

3. Follow up inspections for settlements are required. Should settlement occur, the Contractor shall be responsible for all necessary repairs.

IX. LIGHTING CONTROL

A. The exterior/security LED luminaires shall be controlled through the building lighting control system as shown on the plans. If the exterior/security LED luminaires are installed and energized prior to the lighting control system and/or prior to the lighting control system being properly programmed, this contractor shall install TEMPORARY photo control sensor(s) for the lighting fixtures circuit(s) so that the exterior/security LED luminaires operate dusk till dawn. At no time shall the exterior/security LED luminaires operate 24 hours a day. Once the lighting control system is installed and properly programmed the TEMPORARY photo control sensors shall be removed.

X. FIELD QUALITY CONTROL

A. Prior to final inspection, this Contractor shall check all exterior/security LED luminaires, poles and concrete bases for damages during construction and replace the damaged luminaires or poles and repair or replace the concrete bases where necessary at no additional expense to the Owner. All exterior/security LED luminaires shall be cleaned and complete with all light engines and drivers at the time of final acceptance of the building.

B. Luminaires shall be checked for proper orientation on pole, proper reflector orientation and proper IES distribution type.

END OF SECTION

NOTE: SECTION IS STILL UNDER REVIEW. FINAL COORDINATION SHALL OCCUR WITH PGCPS IT DEPARTMENT.

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

B. All contractors performing low voltage wiring must be approved by the PGCPS Information Technology office. In all cases wiring must conform to these specifications as well as the "Standards for Telecommunications Distribution Systems" as published by the Maryland State Department of Education Instructional Technology Unit.

II. SCOPE

A. The work covered under this Section shall include furnishing and installing fully operational and complete data network systems (including LAN wiring and network cabling) as shown on the Drawings and herein specified.

III. QUALITY ASSURANCE

A. All equipment, materials, and their installation shall conform to the requirements of the National Electrical Code (NEC), local code requirements, and these Specifications.

B. All equipment and materials shall be listed by Underwriters Laboratories, Inc. (UL) for their intended use and shall bear the UL label.

C. Equipment shall be constructed in accordance with National Electrical Manufacturer's Association (NEMA) standards.

D. Submittals are required in accordance with SECTION 260500 of these Specifications.

1. Submittals shall include a preliminary schedule to perform the infrared scans described in Part 3 of this specification. The schedule shall be based on the contractual substantial completion date for this project.

E. All infrastructure cabling must be part of an end to end solution complete with manufacturers’ warranties.

Part 2 - Products

I. GENERAL STANDARDS:

A. All wireless equipment must be HPE/Aruba Networks, specified in the scope of work. All PDUs must be rack mounted APC units with network interface cards (NIC) and must be configured to PGCPS configuration standards. It is strongly recommended that all electronics be purchased at the latest possible time in order to insure acquiring the latest

technology.

B. Installation of low voltage cables shall comply with Articles 725, 800, 810 and the following listed articles of the National Electrical Code and articles EIA/TIA 568A (Commercial Building Telecommunications Standards), EIA/TIA 569 (Pathways & Spaces Standards), EIA/TIA 606 (Administration Standards), EIA/TIA 607 (Grounding & Bonding Standards), and local, city, the State of Maryland and Prince George's County laws and regulations.

C. All projects must comply with the "Standards for Telecommunications Distribution Systems" as published by the Maryland State Department of Education Instructional Technology Unit.

D. No splices of any type are permitted in Category 6a Wire or Fiber Optic Cable. If other types of lines such as public address, video, or telephone wires require splicing only crimp type wire connectors shall be used for open unprotected splices, such as Scotch Lock connectors made by 3M Company or approved equal. Standard screw on type wire nuts will not be accepted. Where low voltage cables other than Category 6a Wire or Fiber Optic Cable as specified above, should require splicing above accessible ceiling areas, the cables shall be laid side by side and supported to the building structure approximately 6 to 8 inches behind the splice to prevent any strain from being applied to the splice device and conductors. NOTE: Wire nut type screw-on connectors can be used in approved electrical box for high voltage applications with approved connectors.

E. When materials are provided by PGCPS, the contractor must accept shipment of the said materials at a PGCPS approved location.

F. Due to the volatility of the technology, electronic equipment required will be bid to the Board's most current specifications immediately prior to the required installation date for the material.

G. Advancing technology convergence requires that the data specifications enumerated above must be carefully considered along with: the relevant EdSpec, Video specifications, Audio specifications, Television specifications, Public Address specifications, Security specifications, Fire annunciator and any other low voltage application.

H. All routers shall be manufactured by Cisco. All switches must be manufactured by HPE/Aruba Networks and configured to PGCPS standards.

II. Equipment

A. Connection Drops

1. Individual drops in each instructional space must be placed as far away from each other as possible to allow maximum flexibility for future room use.

2. Each data drop is defined as three (3) Category 6a cables. Each instructional space must have a minimum of three, 3 cable drops.

3. All drops must be within six feet of an operating electrical outlet, as far from water

(sinks, bathrooms, etc.) as possible, as far from outside doors as possible and approximately 18 to 24 inches from the floor.

4. Drops shall not be placed on movable, removable, sliding walls, or on furniture.

5. Connectivity between all drops and closets must be confirmed by the contractor for links to be considered complete. All cable runs must be tested individually using an industry standard Category 6a scanning tester. Fiber and A/V cables should also be tested accordingly. Test results are to be provided on paper and electronically (CAD) along with “as built” diagrams to the OTD. All cables must be labeled at the drop and the patch panel. Fiber ties must be labeled on the fiber patch cables themselves as well as the fiber cans. All network racks must be labeled as well.

6. The outlet box for each network outlet connection must be identified with a unique number(s) assigned for that cable for the facility being wired according to a numbering scheme agreed to by PGCPS and the Contractor. The other end of each cable that has been terminated in an outlet box will be clearly and permanently marked on the RJ-45 patch panel to which the network cable will be attached. The unique number assigned to this cable will be clearly marked on the riser diagram described above, and the wire itself will be clearly marked with a wraparound labeled piece of tape on the cable inside the terminating outlet box and within two feet of that cable’s termination at an RJ-45 patch panel.

B. Pathways:

1. Main services for TV/DATA/VOICE coming into the building from the street, should be housed in 4 inch rigid conduits, from the street to the MDF of the building, and should be terminated either on the wall or in the appropriate rack.

2. When low voltage cables are run through solid walls; a conduit sleeve shall be installed for the cables to pass through. This conduit sleeve shall have either insulated throat connectors, insuliners or bushings installed on both ends of the sleeve. Where a conduit sleeve or other through- penetration device is installed through a fire rated assembly, the opening around the sleeve and the hole through the sleeve shall be sealed with an Underwriters Laboratory approved fire rated sealant material after the cables have been installed. Conduits must be sized appropriately for the amount of cable being pulled through.

C. Copper Cabling:

1. All service and patch cables, unless otherwise specified, will be Four Pair Category 6a Plenum Rated Cable, blue in color. Wireless cables must be green in color. Security Systems must be white in color. All cables should be Hitachi, Hubbell, General, Leviton, Belden, or equivalent quality or better, as approved by PGCPS.

2. No service cable is to exceed 90 meters.

3. All cables should be terminated with appropriate Category 6a equipment in the closet and at the user’s station. RJ-45 Category 6a Patch panels (Hubbell,

Leviton, Belden or equivalent or better quality approved by PGCPS) are required in all closets. Single source end to end solutions are required with a manufacturer's warranty of at least fifteen (15) years.

4. If class two and class three cables are installed in a cable tray they must be type PLTC (Power Limited Tray Cable). (NEC, Art. 725-38).

5. Low voltage cables must be installed/run with the building structure, such as along metal beams, through open web type metal beams and over or below solid metal beams as job conditions permit. If no building structure as mentioned above is available, then some type of approved supporting system shall be installed to support the cable(s). When low voltage cables are installed over, through or below any type of metal beams that have rough surfaces or sharp edges the cables shall not rest on or be secured to these surfaces. For example, open web type metal beams with rough surfaces or sharp edges, support the cable(s) with plastic ties from the round or smooth sided steel cross braces or by other approved means. Also do not strap or let low voltage cables rest on all thread rods. When bends, turns, and splices are made in cable runs allow sufficient slack in the cables at these points and adequately support at these points. (NEC, Article 300-14).

D. Fiber:

1. The new construction team should follow up with Prince Georges county government as well as PGCPS to formulate a plan of using ICBN fiber at new sites.

2. Multi-mode Fiber optic horizontal cables must be aqua in color and consist of 12 strands of multi-mode, plenum rated, 50 micron, OM4, laser certified fiber that is capable of supporting 10Ge data rates up to 550 meters. If the distance is over 550 meters, single mode fiber must be used. Fiber must be terminated in a rack mount cable box using LC style connectors, and must follow all low voltage cable installation rules as specified elsewhere in this contract document.

3. Single-mode fiber optic cables must be yellow in color and consist of 12 stands of single- mode, plenum rated, 9 micron, laser certified fiber that is capable of supporting 100Ge for up to a minimum of 80km. Single-mode fiber cable must be installed and terminated in the MDF on either the wall or in the appropriate rack.

4. All fiber pulled throughout the building must be run in 1 ¼ inch plenum rated, appropriately colored, (yellow for single-mode, orange for multi-mode) innerduct. Furthermore, terminated fiber bulk heads must be labeled accordingly.

5. Use fiber optic 50 micron patch cables, blue in color, to connect remote closets to the main closet to create a collapsed fiber optic backbone. The use of a fiber SFP+ installed internally in the switch is required and will require the use of LC to LC 50 micron patch cords. The fiber backbone will consist of home run fiber to the MDF operating at 10Ge. This will require the use of 10Ge connections in the IDF and a 10Ge fiber switch /switches in the MDF. The switch stack in the MDF must be connected to the 10Ge fiber switch/switches as well.

E. MDF/IDF Configuration:

1. Multiple wiring closets within one installation must be connected directly to a designated main distribution facility (MDF), in a star topology, via 10gb fiber optic cable. Fiber optic cable runs must have a Category 6a cable as specified in item 'C' pulled parallel with the fiber for redundancy regardless of the length of the run.

2. The MDF must contain a router which is to be a Cisco 3650G layer 3, 10/100/1000 switch or newer, with a minimum of 2, 10Ge fiber ports for uplinks for the WAN and LAN. The Router is to also include IP OSPF routing software.

3. Electronic installations will connect incoming high speed digital circuits to a router, typically with a standard RJ45 Category 6a patch cord of the appropriate length, yellow in color, or with a single mode fiber and GBIC, at the proper 1Ge or 10Ge speed, into the main router.

4. For a new High School configuration, connect the router to an approved 10Ge managed fiber switch (Aruba 24/48 port 10Ge SFP+ Fiber switch) with a LC to LC fiber patch cord of the appropriate length. A 10Ge SFP+ uplink will be required by the scope of work for any individual job. If this is a middle school or elementary school configuration, fiber ties can be connected to a fiber module in the switch stack. A fiber switch is not necessary.

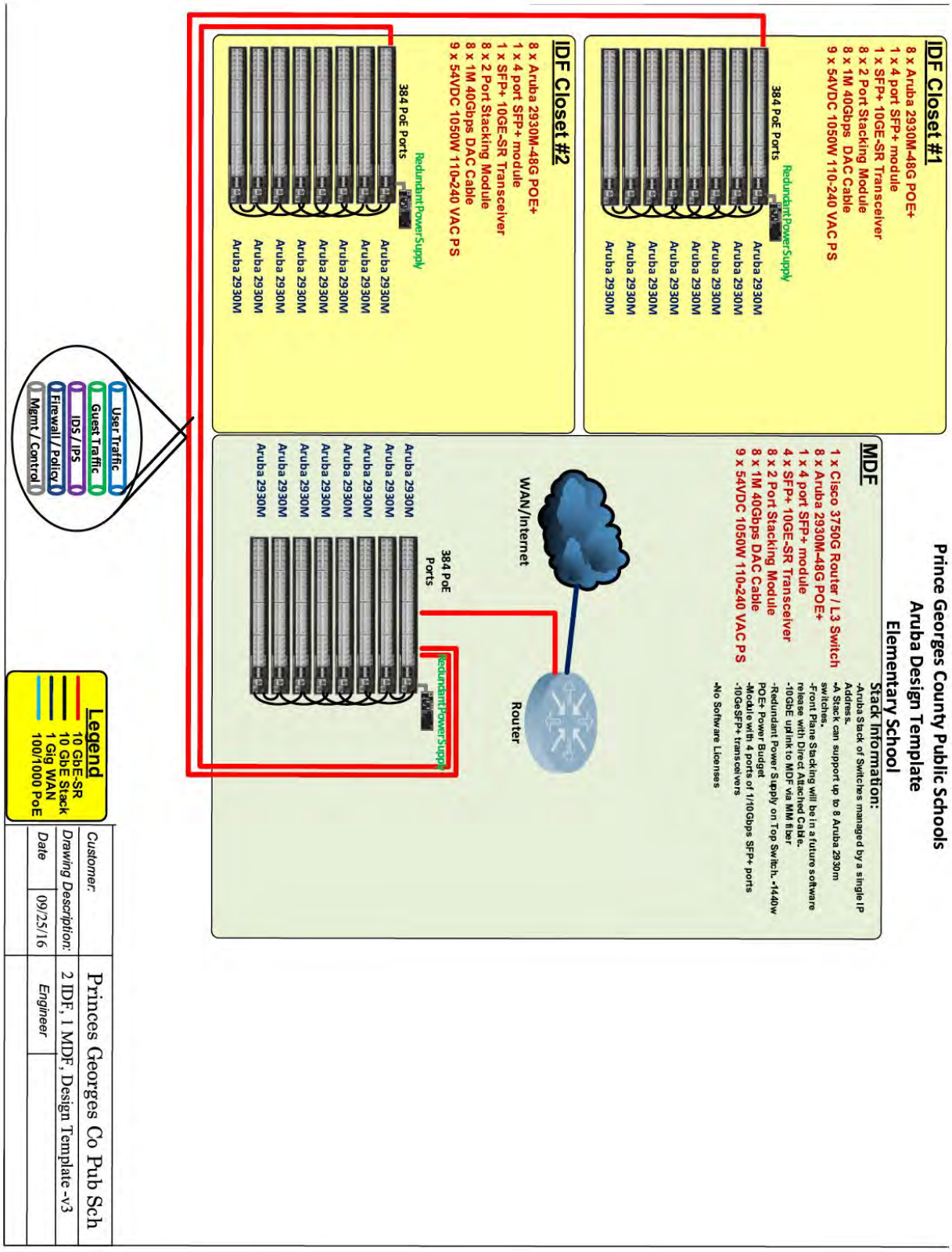
5. The Primary switch in the stack of an IDF must be an HPE/Aruba 2930M or most current or better make and model, and must be linked back to the MDF at 10Ge via fiber backbone. A Special module tray and SFP+ will be required to provide this connection, along with the appropriate length patch cord. This switch must house all, wireless access points and will require dual 1050W power supplies.

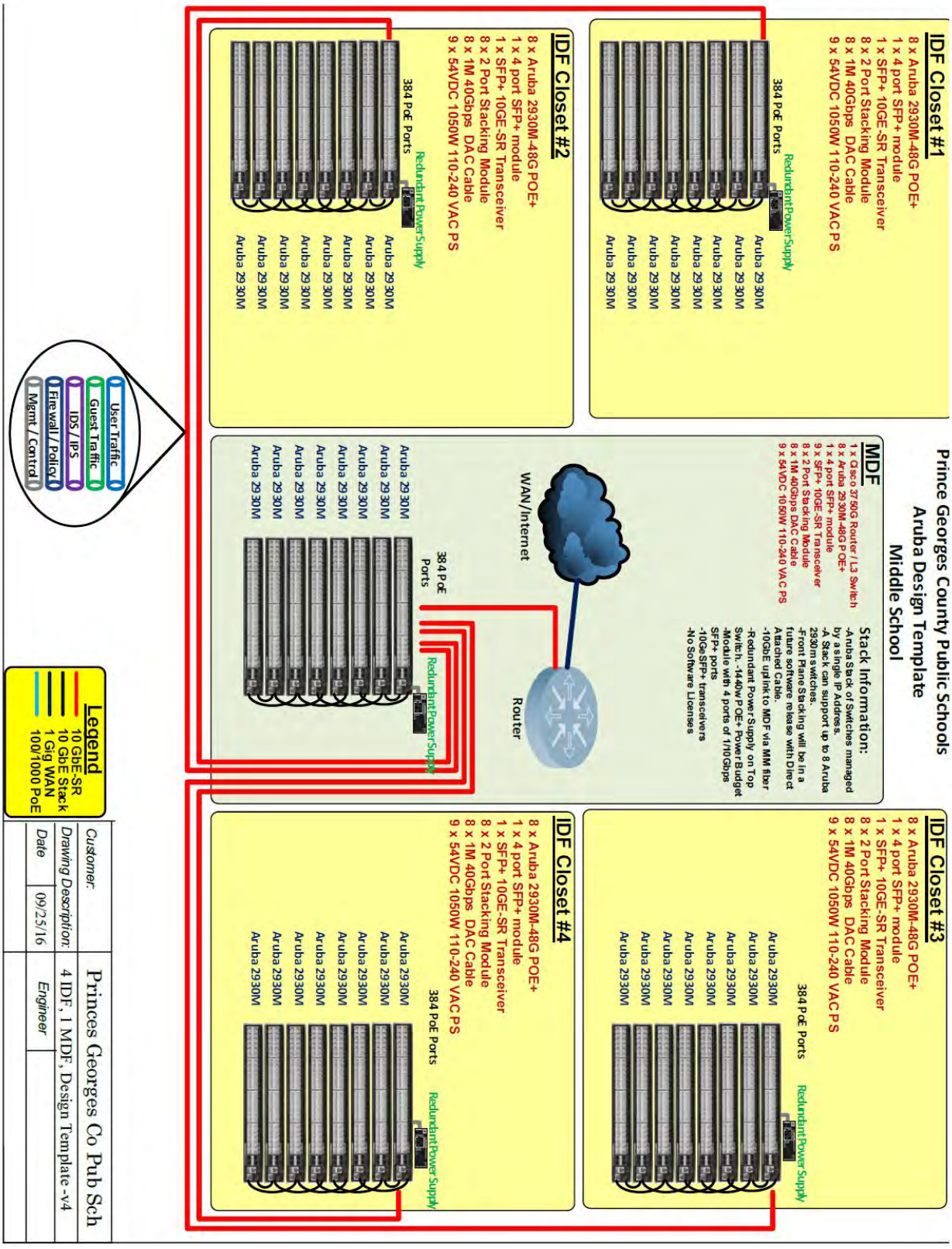
6. Connect each approved 10/100/1000 managed switch (must HPE/Aruba 2930M or most current or better make and model) in the stack to the primary switch in the stack with the appropriate 40Ge DAC stacking cables, in a braided fashion. The switches have limitations on how many can stack together. They must not be stacked higher than what is recommended by the manufacturer.

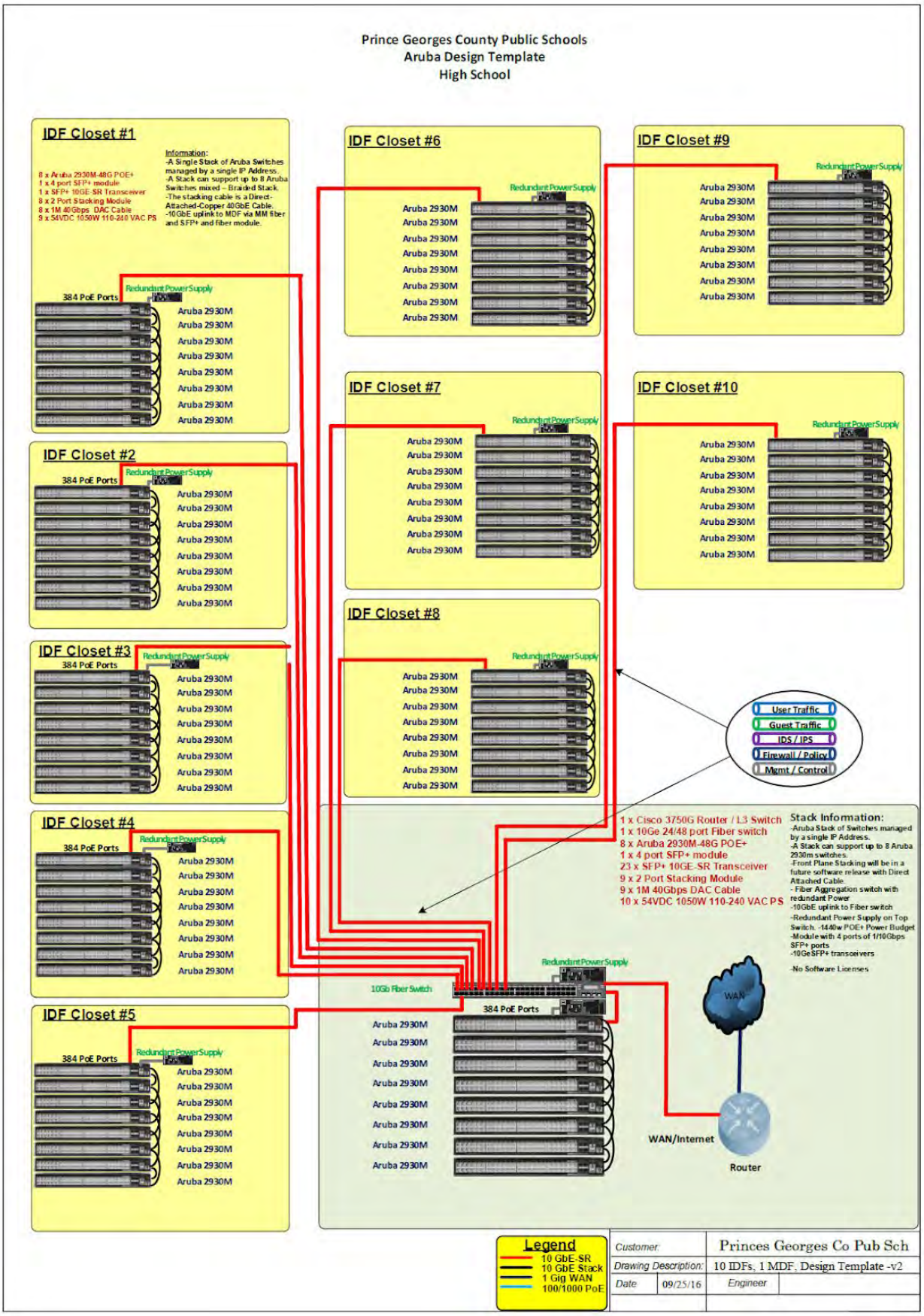
7. The MDF will require a Netbotz 455 unit connected to PGCPS network to APC Struxureware software for monitoring of video, door contact, high/low temperature and HVAC general fault alarm.

8. All installed electronic equipment must be configured according to the PGCPS office of Technology Operations specification. All electronic equipment installed must be accounted for and tagged with the appropriate PGCPS asset tag to be entered into the PGCPS Asset Management Systems. Documentation for all electronic equipment must be provided upon completion of the project. Documentation will conform to the Office of Telecommunication Design standards and will include information such as exact equipment location, mac address, IP address, closet name, serial number, part number, complete network diagram and wiring schematic, etc. Please coordinate with the OTD to provide this said documentation. No exceptions. Contractor must have a Network engineer on board to perform these tasks.

9. An APC AP7802 Metered Rack PDU will be installed in each telecomm rack in lieu of a UPS. This PDU will also be connected to the primary network switch via Ethernet patch cable and configured to PGPCS standards for remote management.


Prince Georges County Public Schools
Aruba Design Template
Elementary School
IDF Closet #1
8 x Aruba 2930M-48G POE+
1 x 4 port SFP+ module
1 x SFP+ 10GE-SR Transceiver
8 x 2 Port Stacking Module
8 x 1M 40Gbps DAC Cable
9 x 54VDC 1050W 110-240 VAC PS
384 PoE Ports
RedundantPowerSupply
Aruba 2930M
IDF Closet #2
8 x Aruba 2930M-48G POE+
1 x 4 port SFP+ module
1 x SFP+ 10GE-SR Transceiver
8 x 2 Port Stacking Module
8 x 1M 40Gbps DAC Cable
9 x 54VDC 1050W 110-240 VAC PS
384 PoE Ports
RedundantPowerSupply
Aruba 2930M
MDF
1 x Cisco 3750G Router / L3 Switch
8 x Aruba 2930M-48G POE+
1 x 4 port SFP+ module
4 x SFP+ 10GE-SR Transceiver
8 x 2 Port Stacking Module
8 x 1M 40Gbps DAC Cable
9 x 54VDC 1050W 110-240 VAC PS
Stack Information:
-Aruba Stack of Switches managed by a single IP Address.
-A Stack can support up to 8 Aruba 2930m switches.
-Front Plane Stacking will be in a future software release with Direct Attached Cable.
-10GbE uplink to MDF via MM fiber
-Redundant Power Supply on Top Switch. -1440w POE+ Power Budget
-Module with 4 ports of 1/10Gbps SFP+ ports
-10GeSFP+ transceivers
-No Software Licenses
WAN/Internet
Router
384 PoE Ports
RedundantPowerSupply
Aruba 2930M
User Traffic
Guest Traffic
IDS / IPS
Firewall / Policy
Mgmt / Control
Legend
10 GbE-SR
10 GbE Stack
1 Gig WAN
100/1000 PoE
Customer:
Princes Georges Co Pub Sch
Drawing Description:
2 IDF, 1 MDF, Design Template -v3
Date
09/25/16
Engineer


Prince Georges County Public Schools
Aruba Design Template
Middle School
IDF Closet #1
8 x Aruba 2930M-48G POE+
1 x 4 port SFP+ module
1 x SFP+ 10GE-SR Transceiver
8 x 2 Port Stacking Module
8 x 1M 40Gbps DAC Cable
9 x 54VDC 1050W 110-240 VAC PS
384 PoE Ports
Redundant Power Supply
Aruba 2930M
MDF
Stack Information:
1 x Cisco 3750G Router / L3 Switch
8 x Aruba 2930M-48G POE+
1 x 4 port SFP+ module
9 x SFP+ 10GE-SR Transceiver
8 x 2 Port Stacking Module
8 x 1M 40Gbps DAC Cable
9 x 54VDC 1050W 110-240 VAC PS
-Aruba Stack of Switches managed by a single IP Address.
-A Stack can support up to 8 Aruba 2930m switches.
-Front Plane Stacking will be in a future software release with Direct Attached Cable.
-10GbE uplink to MDF via MM fiber
-Redundant Power Supply on Top Switch. -1440w POE+ Power Budget
-Module with 4 ports of 1/10Gbps SFP+ ports
-10Gb SFP+ transceivers
-No Software Licenses
WAN/Internet
Router
IDF Closet #2
8 x Aruba 2930M-48G POE+
1 x 4 port SFP+ module
1 x SFP+ 10GE-SR Transceiver
8 x 2 Port Stacking Module
8 x 1M 40Gbps DAC Cable
9 x 54VDC 1050W 110-240 VAC PS
384 PoE Ports
Redundant Power Supply
Aruba 2930M
IDF Closet #3
8 x Aruba 2930M-48G POE+
1 x 4 port SFP+ module
1 x SFP+ 10GE-SR Transceiver
8 x 2 Port Stacking Module
8 x 1M 40Gbps DAC Cable
9 x 54VDC 1050W 110-240 VAC PS
384 PoE Ports
Redundant Power Supply
Aruba 2930M
IDF Closet #4
8 x Aruba 2930M-48G POE+
1 x 4 port SFP+ module
1 x SFP+ 10GE-SR Transceiver
8 x 2 Port Stacking Module
8 x 1M 40Gbps DAC Cable
9 x 54VDC 1050W 110-240 VAC PS
384 PoE Ports
Redundant Power Supply
Aruba 2930M
User Traffic
Guest Traffic
IDS / IPS
Firewall / Policy
Mgmt / Control
Legend
10 GbE-SR
10 GbE Stack
1 Gig WAN
100/1000 PoE
Customer:
Princes Georges Co Pub Sch
Drawing Description:
4 IDF, 1 MDF, Design Template -v4
Date
09/25/16
Engineer


Prince Georges County Public Schools
Aruba Design Template
High School
IDF Closet #1
8 x Aruba 2930M-48G POE+
1 x 4 port SFP+ module
1 x SFP+ 10GE-SR Transceiver
8 x 2 Port Stacking Module
8 x 1M 40Gbps DAC Cable
9 x 54VDC 1050W 110-240 VAC PS
Information:
-A Single Stack of Aruba Switches managed by a single IP Address.
-A Stack can support up to 8 Aruba Switches mixed – Braided Stack.
-The stacking cable is a Direct-Attached-Copper 40GbE Cable.
-10GbE uplink to MDF via MM fiber and SFP+ and fiber module.
384 PoE Ports
Redundant Power Supply
Aruba 2930M
IDF Closet #2
IDF Closet #3
IDF Closet #4
IDF Closet #5
IDF Closet #6
IDF Closet #7
IDF Closet #8
IDF Closet #9
IDF Closet #10
User Traffic
Guest Traffic
IDS / IPS
Firewall / Policy
Mgmt / Control
1 x Cisco 3750G Router / L3 Switch
1 x 10Ge 24/48 port Fiber switch
8 x Aruba 2930M-48G POE+
1 x 4 port SFP+ module
23 x SFP+ 10GE-SR Transceiver
9 x 2 Port Stacking Module
9 x 1M 40Gbps DAC Cable
10 x 54VDC 1050W 110-240 VAC PS
Stack Information:
-Aruba Stack of Switches managed by a single IP Address.
-A Stack can support up to 8 Aruba 2930m switches.
-Front Plane Stacking will be in a future software release with Direct Attached Cable.
- Fiber Aggregation switch with redundant Power
-10GbE uplink to Fiber switch
-Redundant Power Supply on Top Switch. -1440w POE+ Power Budget
-Module with 4 ports of 1/10Gbps SFP+ ports
-10GeSFP+ transceivers
-No Software Licenses
10Gb Fiber Switch
WAN
WAN/Internet
Router
Legend
10 GbE-SR
10 GbE Stack
1 Gig WAN
100/1000 PoE
Customer: Princes Georges Co Pub Sch
Drawing Description: 10 IDFs, 1 MDF, Design Template -v2
Date 09/25/16
Engineer

III. ELECTRICAL REQUIREMENTS:

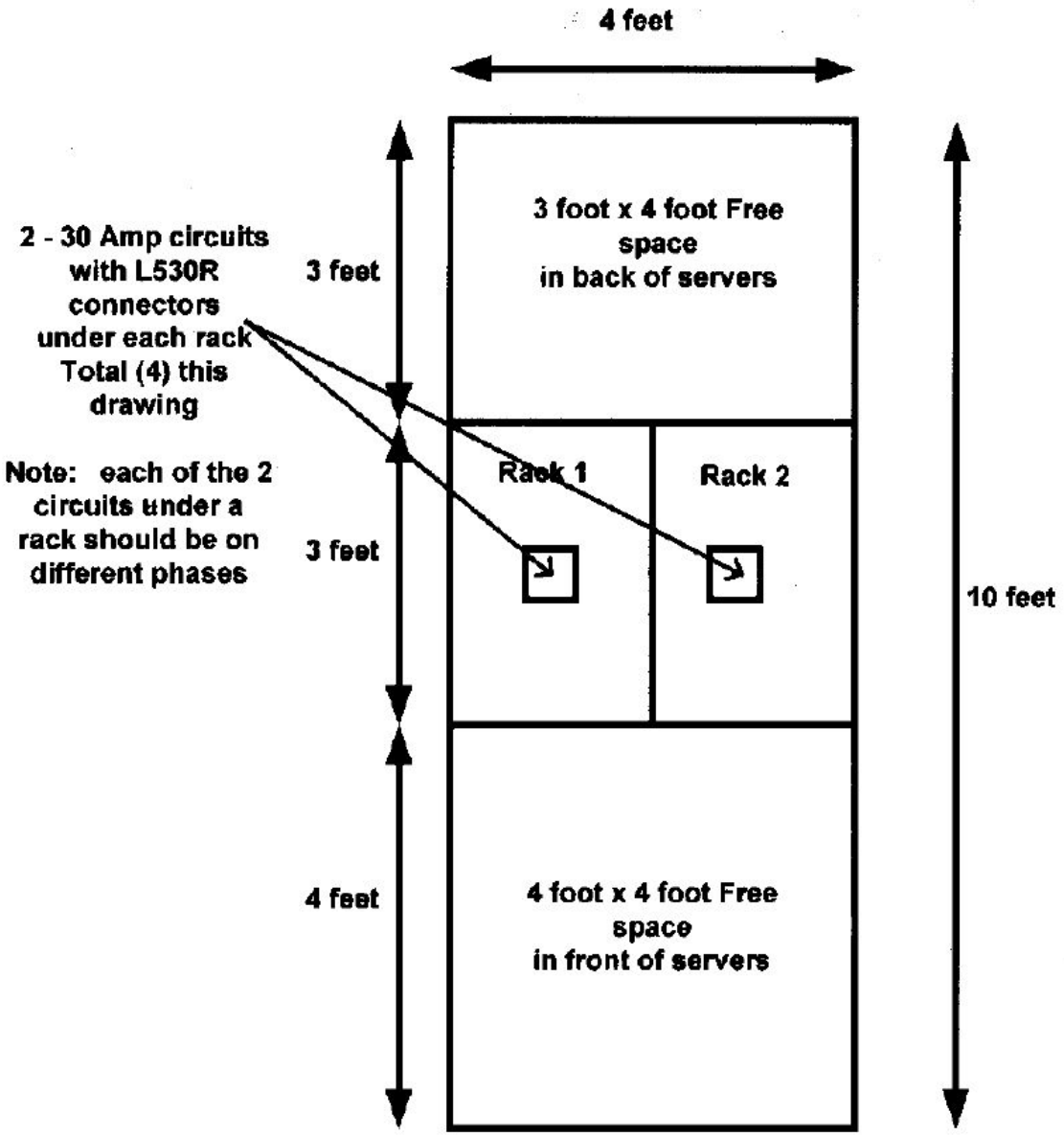
A. Telecomm closets in new construction or renovations must provide for two, 30 ampere L530R electrical outlets per rack, each on dedicated circuits that are on a backup power generator. Each circuit must be on separate phases.

B. Each rack will also require 2, 20 ampere duplex dedicated circuits, also tied to a backup power generator.

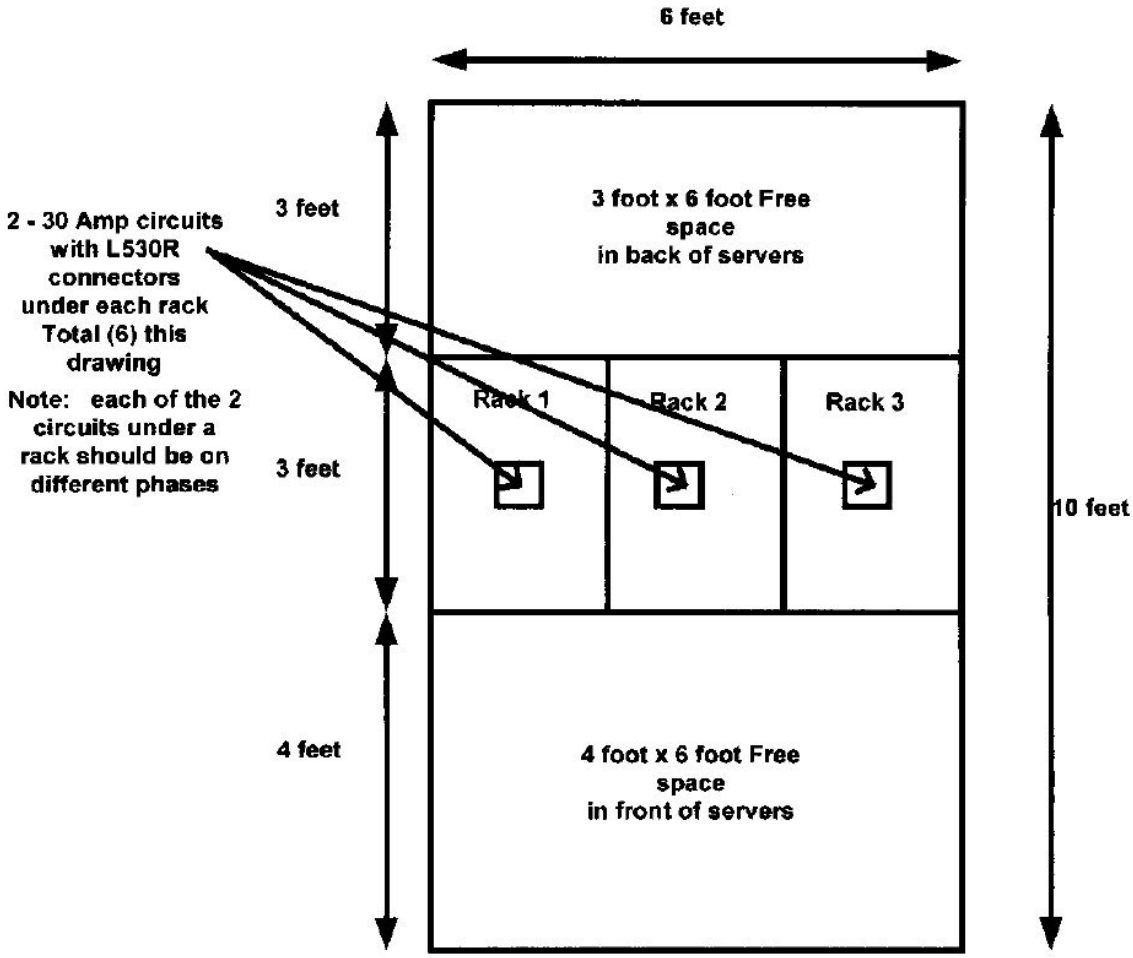
C. It is recommended that a Flywheel(s) with a bypass cabinet be installed. It should power the MDF and all LAN closets, main office including Principles office, building HVAC including pumps and boiler room equipment, main fire alarm panel, burglar and alarm monitoring systems, security camera system, and building security badge access devices. (Note: An entire building Flywheel solution is also acceptable and maybe more cost effective.)

D. APC AP7802 Metered Rack PDU will be installed in each telecomm rack in lieu of a UPS. This PDU will also be connected to the primary network switch via Ethernet patch cable and configured to PGPCS standards for remote management.

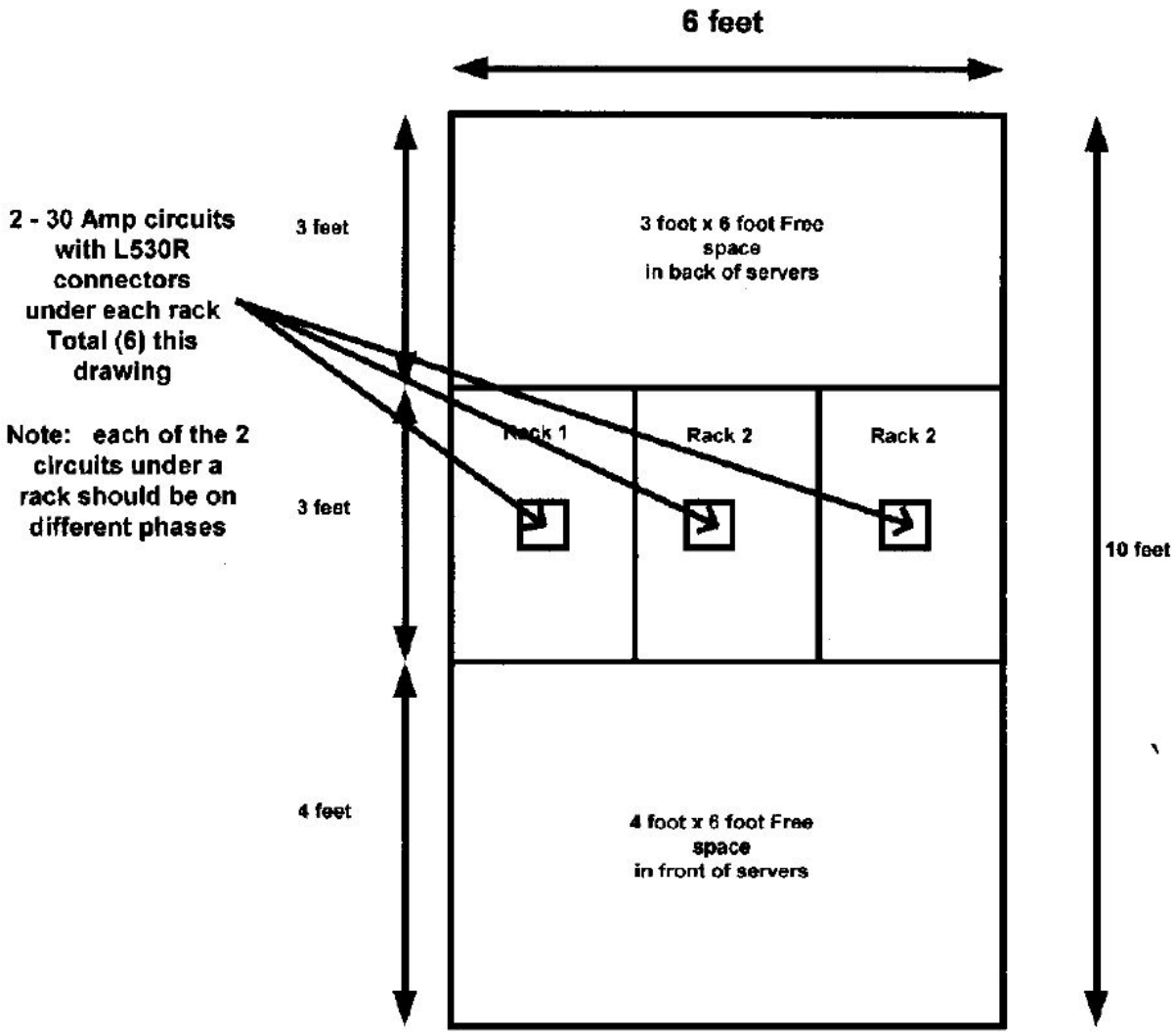
Server Space/ Electrical Requirements - New Elementary Schools Top View



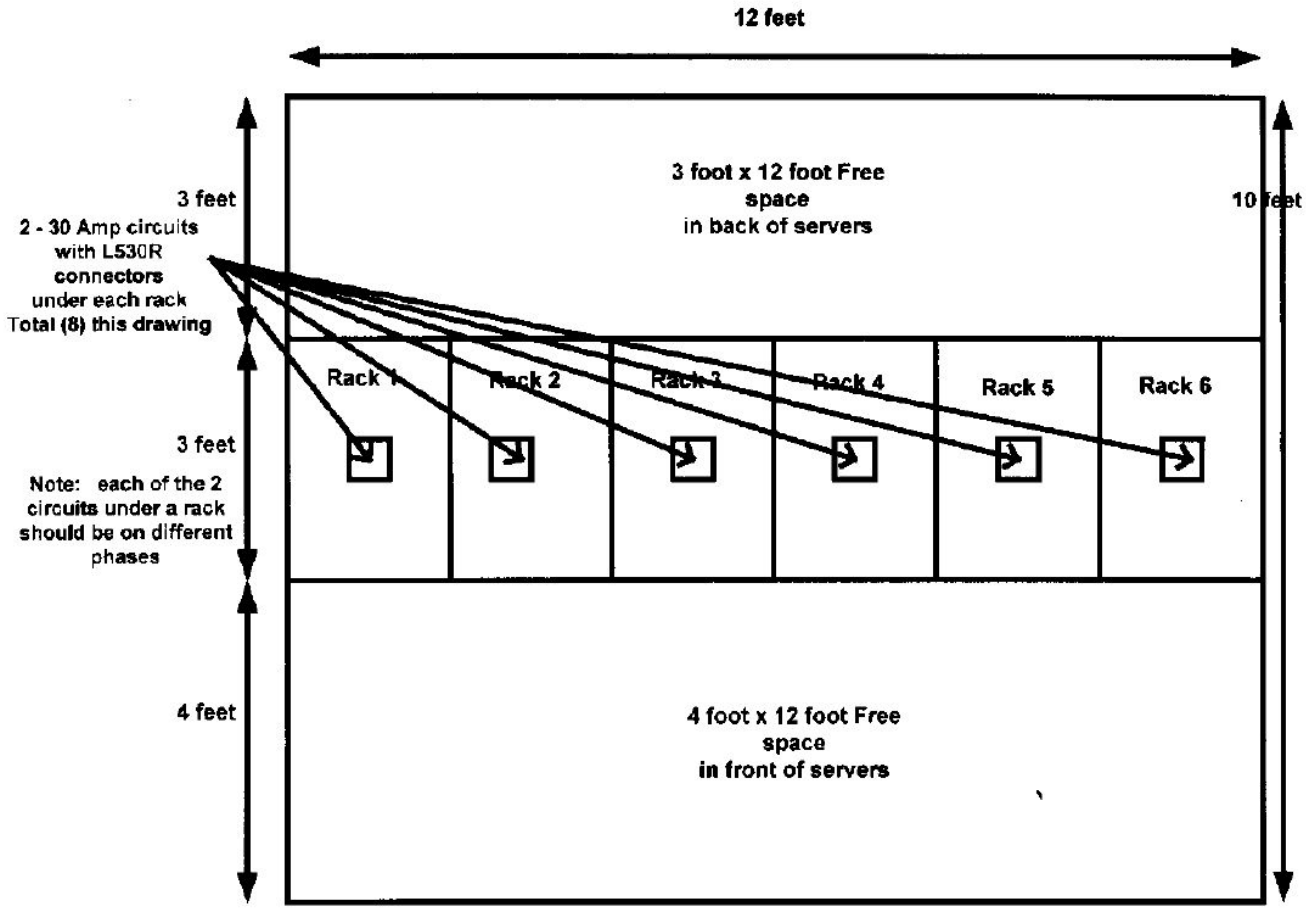
Server Space/ Electrical Requirements - New Elementary and Middle Schools Top View



Server Space/ Electrical Requirements - New Middle Schools Top View



Server Space/ Electrical Requirements - New High Schools Top View



IV. VOICE NETWORK REQUIREMENTS:

A. PGCPS requires the use of Polycom Soundpoint Voice Over IP telephones. These telephones must be purchased, configured, and installed by an approved PGCPS vendor.

B. VoIP telephones must be powered by POE switches (HPE/Aruba 2930M).

C. Each instructional space and office requires a VoIP telephone. Each telephone type will vary depending on type of use. All Classroom and Instructional spaces require a Polycom VVX311 or most current or better, All admin offices, conference rooms, work rooms, etc... require a VVX411 or most current or better. The Main office area and principal's office will require the VVX411 with the equivalent color expansion module. A patch cable of the appropriate length, must be supplied to connect each telephone at the user's work space. Please see the most current PGCPS Telephone specification for further details

D. POTS lines for emergency systems, gas or electric monitoring, elevators, and backup emergency main lines are required. The number of lines will depend on the school type and number of systems that require an analogue line. A 25 pair copper is the minimum required for the analog lines. A phone jack for each device is required in the specified area. If incoming lines come to the building through Fios or similar system, the electric back-up device MUST be connected to the emergency generator, as part of the emergency system.

V. WIRELESS NETWORK REQUIREMENTS:

A. All wiring projects for Prince George's County projects must include wireless communication for laptops, mobile devices, etc. A wireless survey must be conducted prior to construction. This survey will indicate where additional data drops must be installed for wireless access points in order to support seamless, building wide, all-inclusive wireless data communications, and what type of Aruba Networks controller is needed. Cat 6a drops must be calculated and installed in addition to any existing data drops as may be indicated by the survey. The survey and any supporting documentation shall be provided. Please coordinate with OTD for documentation requirements.

B. Following installation and before acceptance of any wireless system an additional wireless survey must be conducted. This survey must confirm complete building wide wireless service. Any areas failing to properly support wireless communication must be provided with additional data drops and equipment to bring an area into compliance. The survey and any supporting documentation shall be provided to the OTD.

C. Data drops must be labeled at the drop and at the patch panel at the appropriate closet.

D. PGCPS telecommunications department requires that Aruba Networks equipment be used for all wireless installations. Aruba technology consists of a central controller (7210 or better) equipped with a fully functional firewall paired with Aruba AP-315 and AP-335/334 Qualified 802.11ac thin access points. A 5-year maintenance plan must be purchased along with the controller. Also the appropriate AP licensing and PEF licensing must be purchased, 1 license of each for each access point.

E. Each access point will require a two cable Cat 6a drop not to exceed 300ft (90 meters)

from a wiring closet. Two cables at each drop are required for redundancy or for future expansion. Cables must be green in color.

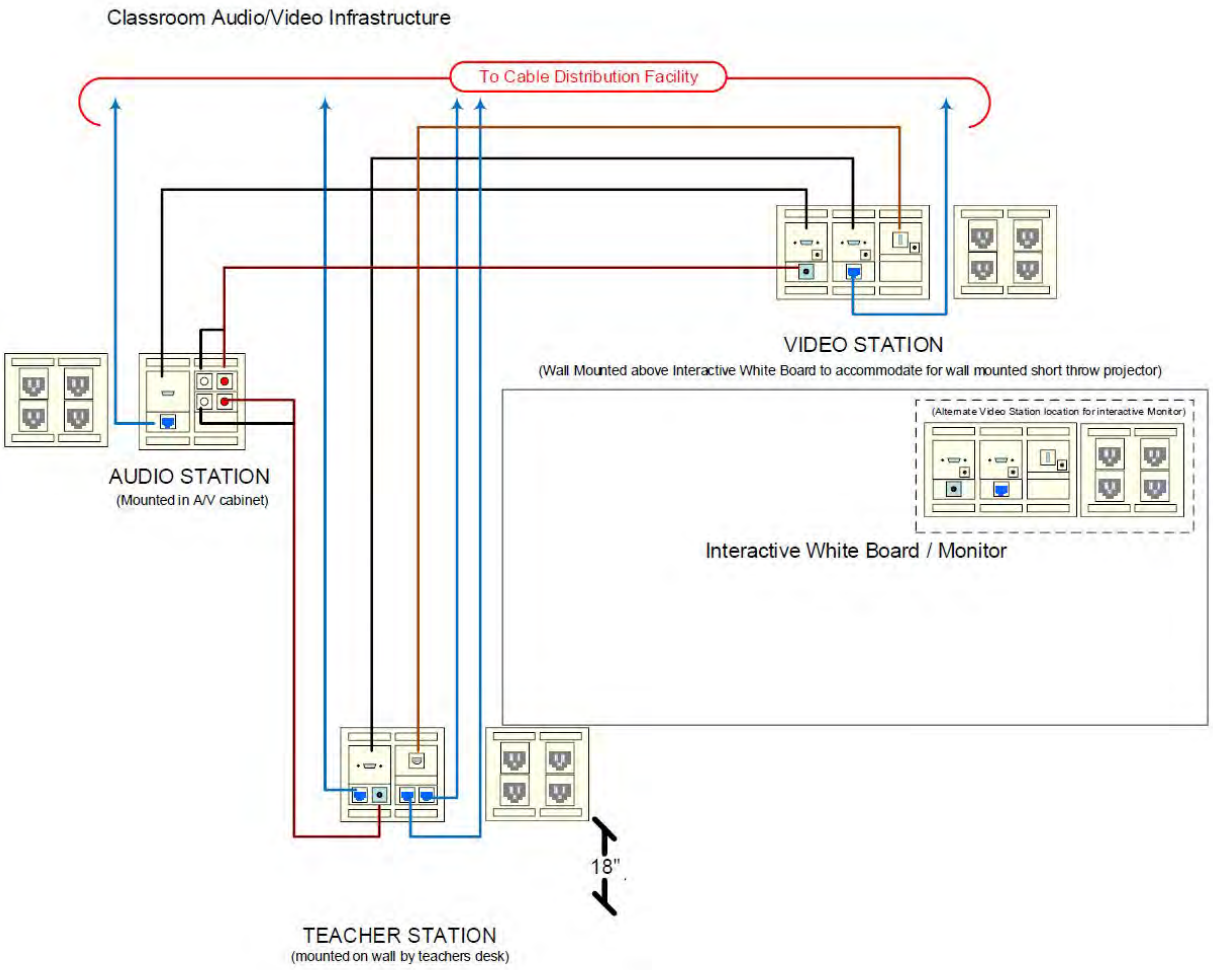
F. Aruba access points require power via PoE (power over Ethernet). A PoE switch (Aruba/HPE 2930M with dual 1050w power supplies) will be required in the appropriate wiring closet, which will supply power to the access points. The switch will be clearly labeled for Power and WIFI at the patch panel along with location of the access point. All cables for each wireless access location must be terminated on their own unique patch panel in the wiring closet. If this is a small installation and cost is an issue, power injectors can be purchased through Aruba instead of a PoE switch.

G. Each instructional space must have an installed Aruba AP-315 Qualified 802.11ac Access point or most current to accommodate for client/user density rather than just radio coverage. Larger rooms such as lecture halls, conference rooms, band rooms, choral rooms, auditoriums, general office areas etc... require the installation of an AP-335. Gyms, Media Centers, Auditoriums, and Cafeterias will require the installation of multiple AP-334s with the appropriate high gain antennae. The total number of AP-334s will be determined by the physical capacity of the space. Example, 60 users per access point.

H. Installation and configuration must be well documented. As-builts will be required with Room location, layout, make, model, s/n, MAC address etc. A floorplan must be submitted with the mac address sticker from the access point in place in the proper location. The contractor must provide an engineer on staff to coordinate documentation and configuration with the PGCPS OTD.

VI. INSTALLATION SPECIFICATIONS FOR A/V TECHNOLOGY SUPPORT

A. Every instructional space must be provided with the infrastructure to support most instructional technology devices such as projectors, digital television tuners, audio enhancement, digital visualizers, interactive white boards, apple TV’s, etc. The required infrastructure provided will allow all of these electronic devices to work seamlessly together.


Classroom Audio/Video Infrastructure
To Cable Distribution Facility
VIDEO STATION
(Wall Mounted above Interactive White Board to accommodate for wall mounted short throw projector)
(Alternate Video Station location for interactive Monitor)
Interactive White Board / Monitor
AUDIO STATION
(Mounted in A/V cabinet)
18"
TEACHER STATION
(mounted on wall by teachers desk)

VII. TEACHER STATION REQUIREMENTS

A. Each instructional space must include a teacher station. A teacher station is composed of the following connectors with appropriate length cables:

1. 3 CAT 6a data jacks, blue in color, that terminate in the nearest cable distribution facility

2. 1 female 3.5mm Audio Jack that ties to the Audio station splitting to RCA left and right Audio

3. 1 female USB B-A connection that ties to the Video station. (may require signal extender for lengthy runs)

4. 1 female HDMI connection that ties to the Video station. (may require signal extender for lengthy runs)

B. A Quad power receptacle must be installed near the teacher station to accommodate for various powered devices.

C. All A/V cables should be terminated in an appropriate “all in one” 2 gang extra deep box that can support two, 2 inch conduits that run above ceiling tiles.

D. Teacher stations cannot be placed on moveable or sliding walls or on furniture and must be on the wall four to six feet to the left or right of interactive white board installation, or white board near a quad electrical outlet and 18 inches from the ground.

E. The appropriate cables must tie back to an Audio station within a cabinet or to a Video station wall mounted above interactive white board to accommodate for a wall mounted short throw projector or at the appropriate height behind a wall mounted interactive monitor. In cases where cables cannot be fished through walls or ceiling tiles, appropriate cable trays/conduit/wire mold must be used to hide all cable runs.

F. The following appropriate gendered patch cords must be provided at the teacher station, for the user to connect their devices:

1. 1 Male to Male 15 ft, HDMI cable

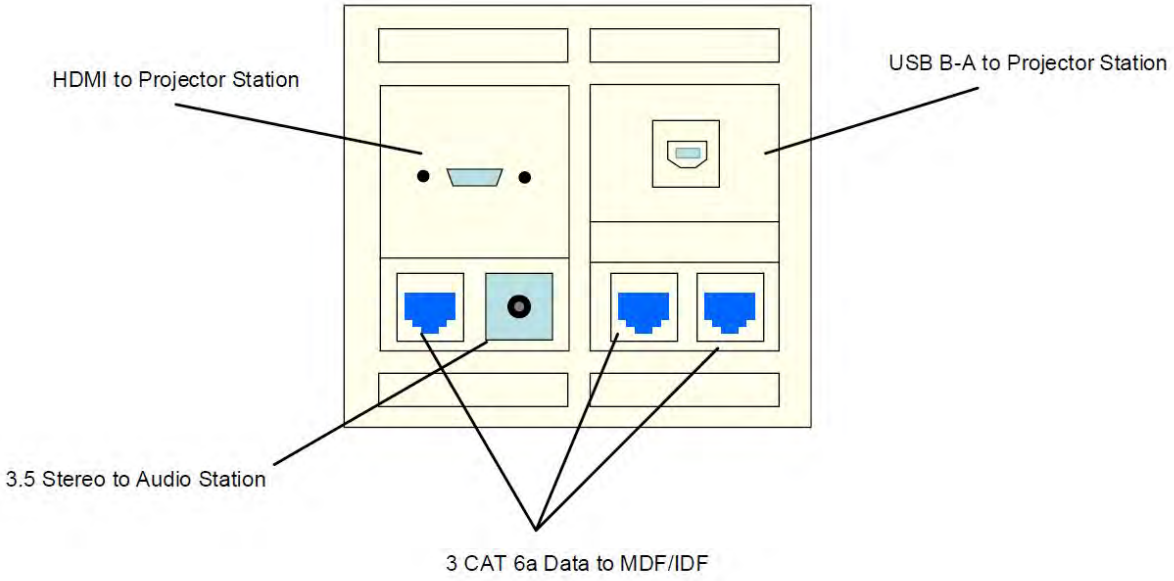
2. 1 Male to Male 15 ft, stereo 3.5mm cable

3. 1 Male to Male 15 ft, USB-A to USB-B cable

4. 3 Male to Male 15 ft, booted CAT6a cables

G. All connectors, cables, plates and necessary materials must be manufactured by Hubbell. PGCPS prefers Hubbell iStation products that use CAT6a as the main mode of A/V data transfer.

Teacher Station



VIII. AUDIO STATION REQUIREMENTS

A. Each instructional space must include an audio station. An audio station is composed of the following connectors with the appropriate length cables and should be located in an approved lockable cabinet or fixed shelf:

1. 1 female CAT 6a data jack, blue in color, that terminates in the nearest cable distribution facility

2. 1 female left and right, red and white RCA jack, that ties to the teacher station condensing to a single 3.5mm jack

3. 1 female left and right, red and white RCA Jack that ties to the video station condensing to a single 3.5mm jack

4. 1 female HDMI connection to the video station (may require signal extender for lengthy runs)

B. A Quad power receptacle must be installed near the audio station to accommodate for various powered devices.

C. All A/V cables should be terminated in an appropriate “all in one” 2 gang extra deep box that can support 2, 2 inch conduits that run above ceiling tiles.

D. Audio stations shall not be placed on moveable or sliding walls or on furniture and must be on a wall either directly above the teacher station with a mounted shelf, or on the wall behind some sort of audio cabinet.

E. The appropriate cables must tie back to a teacher station wall mounted near the teacher’s desk and electrical outlet, or to a video station wall mounted above interactive white board to accommodate for a wall mounted short throw projector or the appropriate height behind a wall mounted interactive monitor. In cases where cables cannot be fished through walls or ceiling tiles, appropriate cable trays/conduit/wire mold must be used to hide all cable runs.

F. The following appropriate gendered patch cords must be provided at the Audio station, for the user to connect their devices:

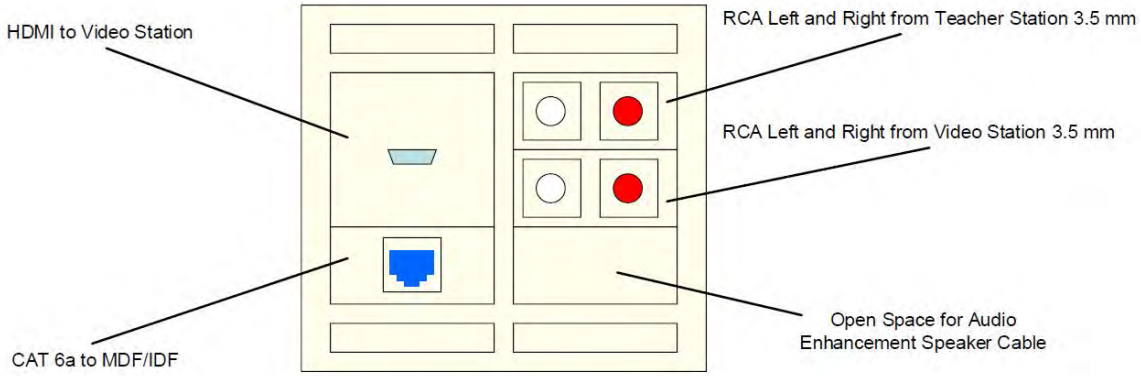
1. 2 Male to Male red and white 6ft, RCA cables

2. 1 Male to Male 6ft, HDMI cable

3. 1 Male to Male 6ft, booted CAT6a cable

G. All connectors, cables, plates and necessary materials must be manufactured by Hubbell. PGCPS prefers Hubbell iStation products that use CAT6a as the main mode of A/V data transfer.

Audio Station



IX. VIDEO STATION REQUIREMENTS

A. Each instructional space must include a Video station. A Video station is composed of the following connectors with the appropriate length cables:

1. 1 female CAT 6a data jack, blue in color, that terminates in the nearest cable distribution facility

2. 1 female USB A-B that ties back to the teacher station (may require signal extender for lengthy runs)

3. 2 female HDMI connections, 1 tying back to the audio station, and one tying back to the teacher station. (may require signal extender for lengthy runs)

4. 1 female 3.5mm Audio Jack that ties to the Audio station splitting to RCA left and right Audio

B. A Quad power receptacle must be installed near the audio station to accommodate for various powered devices.

C. All A/V cables should be terminated in an appropriate “all in one” 3 gang extra deep box that can support 3, 1 1/2 inch conduits that run above ceiling tiles.

D. In cases where cables cannot be fished through walls or ceiling tiles, appropriate cable trays/conduit/wire mold must be used to hide all cable runs.

E. Interactive white boards, projectors, or Monitors will be provided by PGCPS. Contractors are urged to install these devices in order to fulfill the warranty of the defined infrastructure.

F. The following appropriate gendered patch cords must be provided at the Audio station, for the user to connect their devices:

1. 2 Male to Male 6ft, HDMI cables.

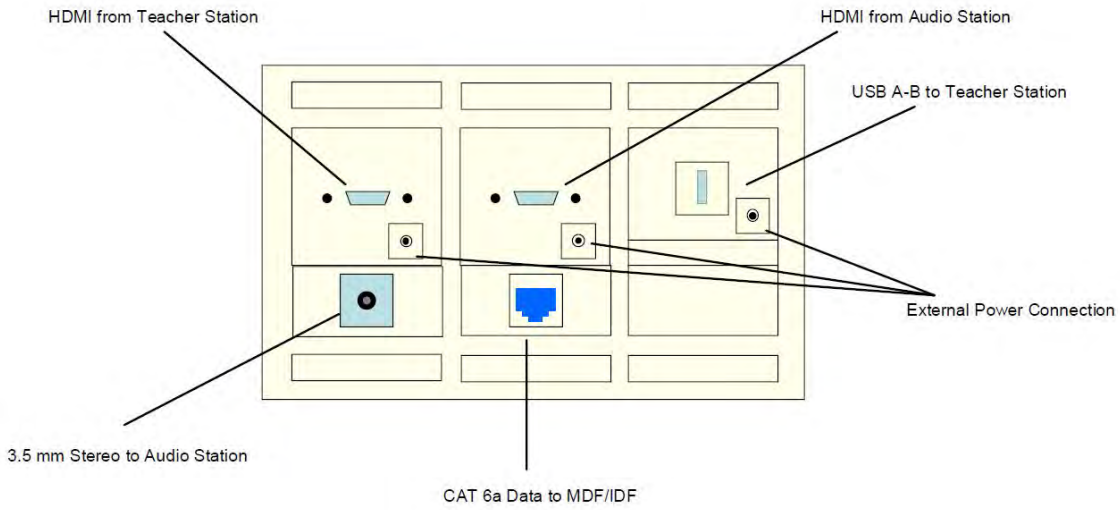
2. 1 Male to Male 6ft, 3.5mm to 3.5mm audio cable.

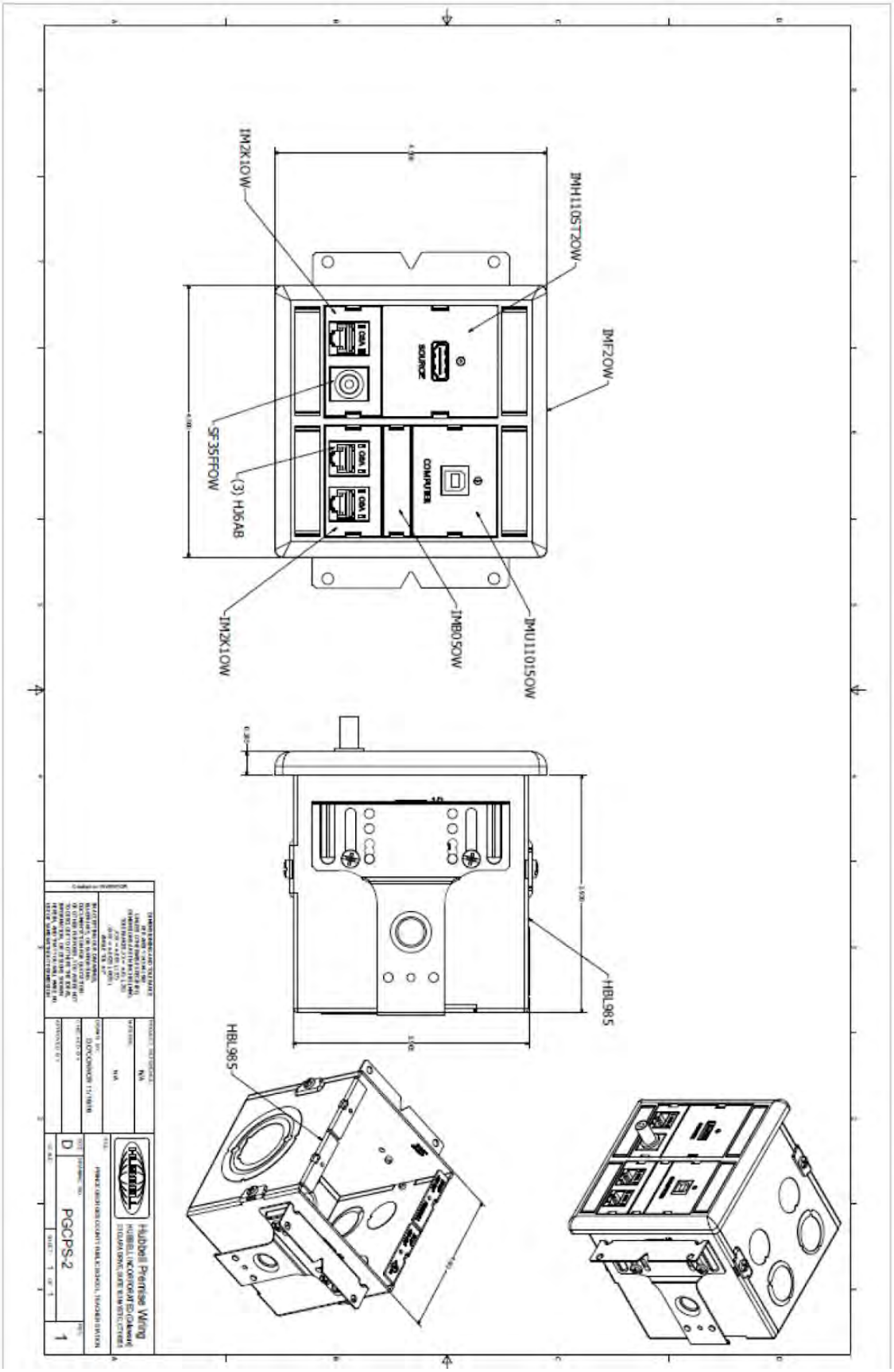
3. 1 Male to Male 6ft, USB-A to USB-B cable

4. 1 Male to Male 6ft, booted CAT6a cable

G. All connectors, cables, plates and necessary materials must be manufactured by Hubbell. PGCPS prefers Hubbell iStation products that use CAT6a as the main mode of A/V data transfer.

Video Station

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PGCPS-2
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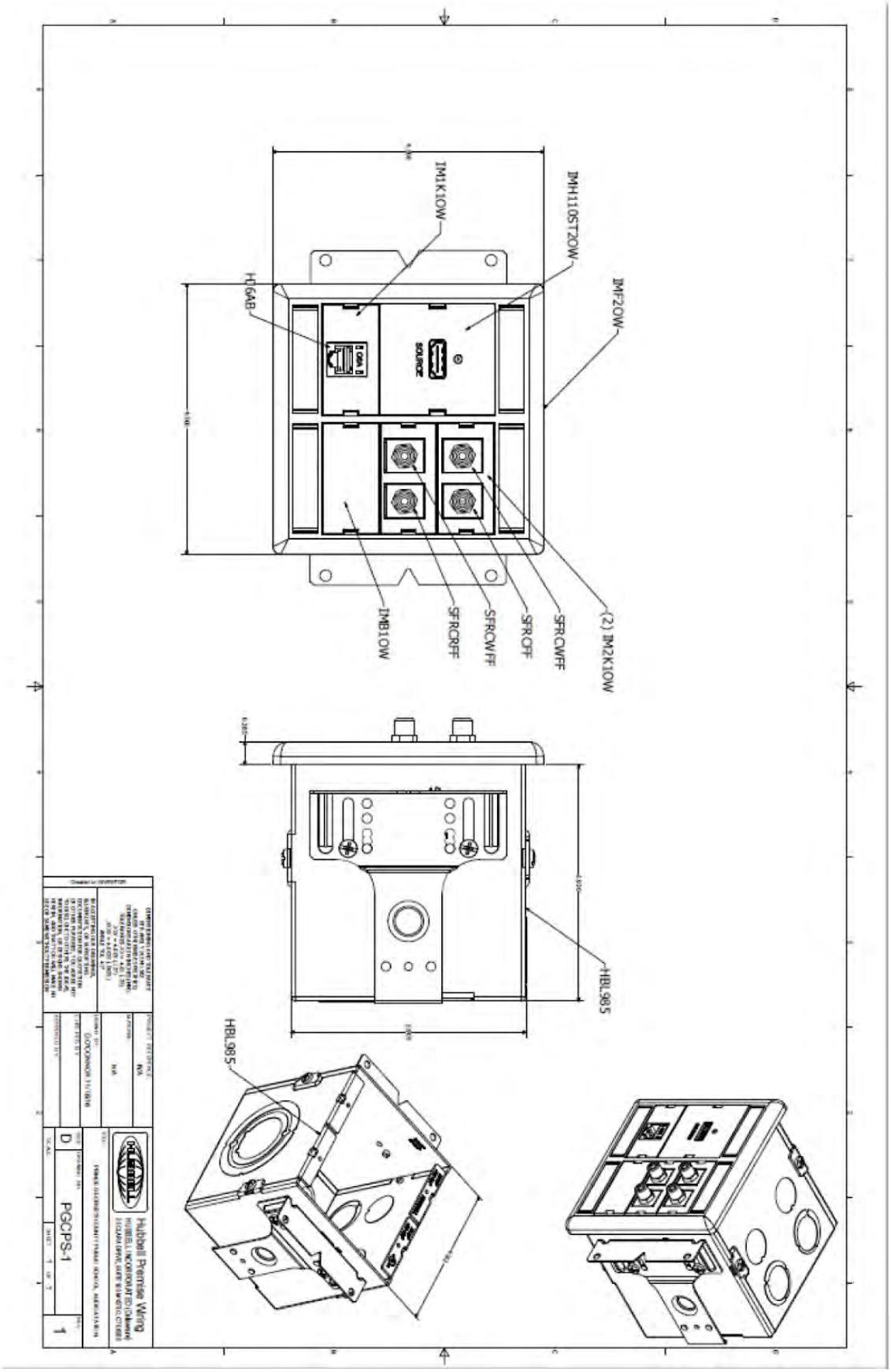
1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IMB10W
SFRCRFF
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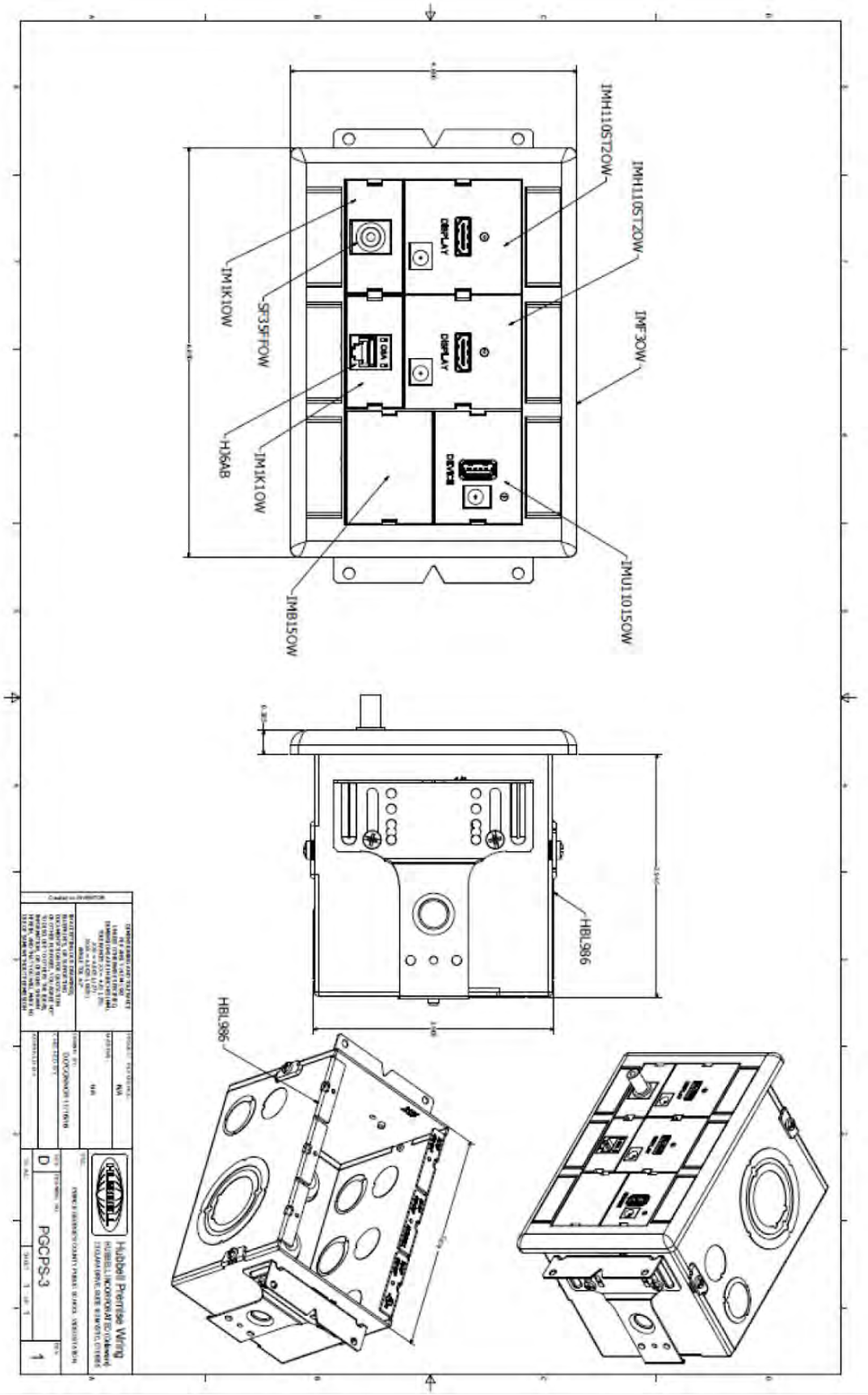
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HBL986
Hubbell Premise Wiring
PGCPS-3
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Part 3 - Execution

I. INSTALLATION

A. The installation will be implemented without exception according to this contract or on the drawings that specify quantities and types of material, necessary devices, and specifies whether these items are to be provided by the contractor or by PGCPS.

B. All low voltage and fiber optic cables shall be supported and strapped in an approved manner. The spacing of these supports must be from 4-1/2 to 8 feet depending on job conditions and code requirements. These supports must be installed to provide adequate support and to prevent excess sagging of these cables.

C. All voice and data terminations must be made on patch panels and must be clearly labeled.

D. Copper Cabling Installation

1. All copper wiring will be Category 6a or better Plenum rated cable. Each instructional space will have not less than nine (9) Cat-6a plenum rated cables installed in groups of three. All other spaces will have cables as specified in the scope of work provided by the Office of Telecommunications Design (OTD).

2. All cables must be protected against physical damage. (NEC, Article 300-14).

3. All low voltage cables shall be individually identified every 20 to 30 feet by an approved and easily readable means such as string type name tags, etc. to identify what type of systems the cables are used for.

4. If low voltage cables are installed through a ceiling space system that is used for environmental air and or a return air system, the cables must be labeled “PLENUM OR ENVIRONMENTAL AIR TYPE”.

5. Open, exposed low voltage cables must be installed so that they are a minimum 2 inches away from all electrical power conduits and conductors. (NEC, Article 725-38-al).

6. Low voltage cables must not lay on or be supported by metal duct systems, metal plumbing pipes, sprinkler pipes or other metal-structural surfaces that could cause the cable to be damaged if excessive strain-pressure was put upon the cables.

7. The Contractor must provide and install patch cords for all closet connections using 1 foot patch cables (Blue for data, Green for wireless, White for Security Systems). In addition the contractor must provide one additional 15 foot patch cord for each port in each closet, gray and blue accordingly for use at the user station.

8. Hardware, patch panels, and all local area network electronic support equipment, shall be mounted in a wall mounted or floor standing rack.

E. MDF/IDF Installation

1. Closet installations will use properly secured wall or floor mounted racks containing all patch panels and electronic equipment. Cables must be in ladder racks for a more secure and cleaner installation.

2. Industry standard vertical wire management in each closet must be provided and installed by the vendor. 1 ft. patch cables must be used between patch panels and switches. Horizontal wire management is not needed. 10Ge stacking cables must be used between switches in a braided fashion.

3. All low voltage cables must be installed and secured in a neat, orderly, and code compliant manner. (NEC, Article 110-12). The Contractor is to furnish and install all conduit, sleeves, wire- mold, cable trays, wire ties, Velcro (for patch cables), ladder racks, etc. required to support and protect said wiring in a code compliant fashion.

4. All wiring closets will be supplied with 19" rack(s) capable of supporting specified and needed electronic equipment. Where such racks are not already available, a ¾ inch thick plywood panel can be installed in each wiring closet that is adequate for the mounting of wall mount racks, patch panels and any other specified and necessary electronic equipment that is normally attached to the wall and not placed on a rack. An example of such equipment, but not limited to such equipment, is a POTS patch panel. All wall or floor mount racks shall be grounded with a 4 gauge copper cable.

F. Wireless Network Installation

1. Access points must be ceiling mounted or wall mounted high, below ceiling tiles with the antennae pointing in the down direction.

2. Concealed access points shall be marked with some type of specific tag on the ceiling tile to identify the location of the access point.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include furnishing and installing a complete telecommunications system as shown on the Drawings and herein specified for the distribution of telephone and/or networked data signals.

B. The telephone service into the building shall be provided by VERIZON COMMUNICATIONS. It shall be the responsibility of this Contractor to coordinate with the telephone utility to insure timely delivery of permanent telephone service.

C. The electronic telephone switch and all telephone instruments shall be furnished and installed by the Owner.

D. The existing telecommunications service and system shall remain in operation during the construction period until the new service and system has been installed and tested, ready for operation. After the new service and system has been placed in operation, the existing service and system shall be removed as shown on the Drawings.

III. QUALITY ASSURANCE

A. All equipment and materials for this system shall be listed by Underwriter's Laboratories, Inc. (UL), bear the UL label, and shall be installed in accordance with all requirements of the National Electrical Code (NEC), all state and local codes, and these Specifications.

B. Equipment shall be constructed in accordance with National Electrical Manufacturer's Association (NEMA) standards.

C. All work relating to the telephone service entrance shall comply with the requirements of the telephone utility company.

D. Shop drawing submittals are required per Section 260500 and shall include the following for review. Submittals not containing all of the information listed below will be rejected.

1. Manufacturer's shop drawings for the networking main and sub-distribution frames including the equipment mounting rack and all associated accessories, components, and equipment to be installed therein.

2. Manufacturer's data sheets for the telecommunications outlets and the telecommunications cable.

3. A detailed set of floor plans for the complete building shall be furnished showing

the locations of all equipment and devices and their required interconnections. The interconnections shown shall indicate the number, size, and type of wires as described in this Specification. The layout of all telecommunications system equipment, devices, and conduit routings shall closely follow that shown on the Drawings.

E. This Contractor shall be prepared, upon request by the Owner, to provide proof of the ability to provide the above listed drawings in a mechanical form.

F. This Contractor shall be an AMP, HUBBELL, P&S ACTIVATE, LEVITON, PANDUIT, ORTRONICS, OPTICAL CABLE CORPORATION, and BICSI certified installer of copper and fiber optic cabling systems and have a fully equipped and trained service organization that will have a response time of thirty-six (36) hours or less to the job site. This contractor shall have a minimum of one (1) certified installer on site during construction of this project. This contractor must show evidence of successfully furnishing systems specified for at least five (5) years. This Contractor shall be prepared to show proof of such certification upon request by the Owner. This Contractor shall also be prepared to offer to the Owner upon request, a fifteen (15) year manufacturer's warranty covering defects in material and workmanship in the passive components of the telecommunications wiring system (outlets, patch panels, etc.).

G. Prior to final inspection, this Contractor shall furnish two (2) complete as-built sets of drawings prepared by mechanical drafting methods.

IV. SYSTEM TEST AND ACCEPTANCE

A. Prior to the final site visitation, and acceptance of each construction phased spaces, this Contractor shall conduct an operating test of all telecommunications system cabling. The cabling shall test free from grounds, shorts, and other faults. All connections shall be checked for mechanical and electrical connection. Phased space test results shall be furnished to the Owner in bound binders prior to acceptance.

B. This Contractor shall perform the following tests certifying each telecommunications outlet cable. Test results shall be tabulated listing each outlet (by number), the cable, and the test results.

TEST	FREQUENCY	REQUIREMENTS
1. Impedance:	1 MHz 10 MHz 25 MHz 100 MHz 250 MHz	100 ohms ± 15%

2. Attenuation:	1 MHz	2 dB max. per 100m 6 dB
	10 MHz	max. per 100m
	25 MHz	9.5 dB max. per 100m
	100 MHz	19.8 dB max. per 100m
	250 MHz	32.8 dB max. per 100m
3. Crosstalk (Next):	1 MHz	min. 62 dB
	10 MHz	min. 47 dB
	25 MHz	min. 41 dB
	100 MHz	min. 32 dB

1. Mutual Capacitance: less than 46 pf per meter

2. Cable Length: less than 100 meters

C. Each fiber optic cable shall have a FOIRL specification, bi-directional testing at both 850 nm and 1300 nm with 3 dB light signal loss per km and 2000/500 MHz- km bandwidth at 850/1300nm.

D. This Contractor shall perform all tests in the presence of the Architect/Engineer. This Contractor shall furnish all personnel and test instruments required for use in the test.

E. This Contractor shall be prepared, upon request by the Owner, to show current ownership of all instruments and equipment necessary to perform all of the tests listed above.

V. TRAINING

A. This Contractor shall furnish to the Owner's designated representatives project specific cable plant layout orientation (4 hours).

VI. WARRANTY

A. This Contractor shall deliver the work described herein in a first class operating condition in every respect. This Contractor shall also warrant that the material and workmanship shall be entirely free from defects. Any materials, equipment, or workmanship in which defects may develop before or during the warranty period shall be repaired or replaced at the Contractors own expense. Refer to SECTION 01740 for the start of the warranty period. The contractor shall further warrant that all material, equipment, and workmanship used in the installation, but not specifically mentioned in the Drawings and Specifications, is the best of their respective kinds and that the construction and installation was performed in accordance with the best accepted standard practices in all details.

Part 2 - Products

I. CONDUITS

A. This Contractor shall furnish and install underground telephone service entrance conduit(s) as shown on the Drawings and as hereinbefore specified.

B. This Contractor shall furnish and install telephone distribution conduits, minimum 1/2 inch, only as shown on the Drawings and as hereinbefore specified.

C. This Contractor shall furnish and install all fiber optic cable in conduit for the entire run. Minimum conduit size for fiber optic cable shall be ½ inch.

II. TELECOMMUNICATIONS EQUIPMENT LOCATIONS

A. This Contractor shall furnish and install where shown on the Drawings, wall mounted main and sub-distribution telecommunications equipment locations consisting of fire resistant ¾ inch thick plywood backboards and networking hubs as hereinafter described and as detailed on the Drawings.

III. TELECOMMUNICATIONS OUTLETS

A. This Contractor shall furnish and install where shown on the Drawings, wall mounted telecommunications outlets each consisting of: one (1) ORTRONICS Part No. OR-40300270 single-gang faceplate; one (1) ORTRONICS Part No. OR- 41900018 TrackJack frame; one (1) ORTRONICS Part No. OR-TJ600-00 (black) single category 6, RJ-45 (568A/B) TrackJack insert; two (2) ORTRONICS Part No. OR-63700005 single RJ-25C TrackJack inserts; and one (1) ORTRONICS Part No. OR-42100002 blank TrackJack insert mounted in a single-gang outlet box. The equivalent outlets as manufactured by AMP, HUBBELL, P&S ACTIVATE, LEVITON, PANDUIT, or OPTICAL CABLE CORPORATION. Will also be considered provided they are fully equal to the type specified herein.

B. This Contractor shall furnish and install where shown on the Drawings, wall mounted data only outlets each consisting of: one (1) ORTRONICS Part No. Part No. OR-40300270 single-gang faceplate; one (1) ORTRONICS Part No. OR- 41900017 TrackJack frame; two (2) ORTRONICS Part No. OR-TJ600-00 (black) single category 6, RJ-45 (568A/B) TrackJack inserts; and one (1) ORTRONICS Part No. OR-42100002 blank TrackJack insert mounted in a single-gang outlet box. The equivalent outlets as manufactured by AMP, HUBBELL, P&S ACTIVATE, LEVITON, PANDUIT, or OPTICAL CABLE CORPORATION. will also be considered provided they are fully equal to the type specified herein.

C. This Contractor shall furnish and install where shown on the Drawings, flush floor telecommunications outlets consisting of a telecommunications jack assembly mounted in a flush floor outlet box as described on the Drawings and elsewhere in these Specifications.

D. This Contractor shall furnish and install were detailed on the drawings, telecommunications and data only outlets in the surface raceway manufactured by

ORTRONICS or EQUAL AS MANUFACTURED BY PASS AND SEYMOUR ACTIVATE SERIES, or PANDUIT.

E. This Contractor shall furnish and install where shown on the Drawings, wall mounted telephone outlets consisting of a four (4) inch square flush outlet box with plaster cover and a single gang stainless steel cover plate with a 3/8-inch diameter bushed opening.

IV. NETWORKING MAIN DISTRIBUTION FRAME (MDF)

A. This Contractor shall furnish and install where shown on the Drawings, a floor mounted networking main distribution frame as detailed on the Drawings. Components shall be as shown or equivalent as manufactured by ADC, AMP, HUBBELL, P&S ACTIVATES, LEVITON, PANDUIT, or OPTICAL CABLE CORPORATION.

1. Furnish and install ORTRONICS Part No. OR-604004600 heavy duty EIA compliant nineteen (19) inch wide, seven (7) foot tall equipment racks (of the quantity detailed on the Drawings) each consisting of fifteen (15) inch self-supporting base; two (2) three (3) inch wide side channels; top angle; and assembly hardware. All components shall have a brushed aluminum finish. Side channels shall be drilled and tapped on both sides.

2. Furnish and install ORTRONICS Part No. OR-FCM-19-2L horizontal cable management modules (CM-1) including all required mounting hardware in the locations and of the quantity detailed on the Drawings.

3. Furnish and install ORTRONICS Part No. OR-DVMS704 vertical cable management modules (CM-2) with cover including all required mounting hardware in the locations and of the quantity detailed on the Drawings.

4. Furnish and install ORTRONICS Part No. OR-60400405 cable management shelves (CM-3) including all required mounting hardware in the locations and of the quantity detailed on the Drawings.

5. Furnish and install ORTRONICS Part No. OR-DVMS706 vertical cable management modules (CM-4) with cover including all required mounting hardware in the locations and of the quantity detailed on the Drawings.

6. Furnish and install light interface unit(s). The unit(s) shall be rack mounted type with a strain bracket for securing cables. A light interface unit, which meets this specification, shall be CORNING Part No. CCH-01U with Two (2) Part No. CCH-CP12-E4 chamber connector panel and part no. 95- 050-99-X type "LC" multimode bulkhead interconnects of the quantity indicated. Other acceptable manufacturers are RADIANT COMMUNICATIONS, FONS, and PASS and SEYMOUR ACTIVATE.

7. Furnish and install ORTRONICS Part No. OR-PHD68U96 ninety-six (96) port, RJ-45 (568A/B) type patch panel(s) suitable for rack mounting in the quantity required to cross connect all of the telecommunications and/or data only outlet RJ-45 ports.

8. Furnish and install ORTRONICS Part No. OR-PHD68U48 forty-eight (48) port.

RJ-45 (568A/B) type patch panel(s) suitable for rack mounting in the quantity required to cross connect all of the wireless access point wiring. Label patch panel as "MAIN DISTRIBUTION WIRELESS ACCESS POINT PATCH PANEL (MD-WAPP)."

9. Furnish and install ORTRONICS Part No. OR-PHD68U48 forty-eight (48) port. RJ-45 (568A) type patch panel(s) suitable for rack mounting in the quantity required to cross connect all of the CCTV wiring. Label patch panel as "CCTV CAMERAS".

10. Furnish and install ORTRONICS Part No. OR-30200145 one hundred (100) pair rack mounted 110 punch down blocks including all necessary mounting hardware in the locations detailed on the Drawings, in the quantity required to terminate all of the 100 pair distribution cables and 4 pair station cables from the RJ-25C ports.

11. Furnish and install ORTRONICS Part. No. OR-8050F157B fifty (50) pair “66” clip connecting blocks mounted by this Contractor on a blank rack mounting panel including all necessary mounting hardware in the locations and of the quantity detailed on the Drawings.

12. The networking main distribution frame shall include one (1) rack mounted 110-volt power strip/surge suppressor in each floor-mounted rack. Each power strip/surge suppressor shall consist of eight (8) front mounted outlets, and eight (8) foot long AC power cord. The rack mounted 110-volt power strip/surge suppressor shall be AMERICAN POWER CONVERSION (APC) Part No. AP7900.

13. The networking main distribution frame shall have a nameplate of 1/16- inch thick laminated plastic with 3/16-inch high white engraved letters on a black background. The nameplate shall identify the frame as indicated on the Drawings and shall be mounted on the front top of the frame.

V. NETWORKING SUB-DISTRIBUTION FRAME(S) (SDF)

A. This Contractor shall furnish and install where shown on the Drawings, a floor mounted networking sub-distribution frame as detailed on the Drawings. Components shall be as shown or equivalent as manufactured by AMP, HUBBELL, P&S ACTIVATE, LEVITON, PANDUIT, or OPTICAL CABLE CORPORATION.

1. Furnish and install ORTRONICS Part No. OR-604004600 heavy duty EIA compliant nineteen (19) inch wide, seven (7) foot tall equipment rack each consisting of fifteen (15) inch self-supporting base; two (2) three (3) inch wide side channels; top angle; and assembly hardware. All components shall have a brushed aluminum finish. Side channels shall be drilled and tapped on both sides.

2. Furnish and install ORTRONICS Part No. OR-FCM-19-2L horizontal cable management modules (CM-1) including all required mounting hardware in the locations and of the quantity detailed on the Drawings.

3. Furnish and install ORTRONICS Part No. OR-DVMS704 vertical cable management modules (CM-2) with cover including all required mounting hardware in the locations and of the quantity detailed on the Drawings.

4. Furnish and install ORTRONICS Part No. OR-DVMS706 vertical cable management modules (CM-4) with cover including all required mounting hardware in the locations and of the quantity detailed on the Drawings.

5. Furnish and install light interface unit(s). The unit(s) shall be rack mounted type with a strain bracket for securing cables. A light interface unit, which meets this specification, shall be CORNING Part No. CCH-01U with Two (2) Part No. CCH-CP12-E4 chamber connector panel and part no. 95- 050-99-X type "LC" multimode bulkhead interconnects of the quantity indicated. Other acceptable manufacturers are RADIANT COMMUNICATIONS, FONS, and PASS and SEYMOUR ACTIVATE.

6. Furnish and install ORTRONICS Part No. OR-PHD68U96 ninety-six (96) port, RJ-45 (568A) type patch panel(s) suitable for rack mounting in the quantity required to cross connect all of the telecommunications and/or data only outlet RJ-45 ports.

7. Furnish and install ORTRONICS Part No. OR-PHD68U48 forty-eight (48) port. RJ-45 (568A) type patch panel(s) suitable for rack mounting in the quantity required to cross connect all of the wireless access point wiring. Label patch panel as "SUB DISTRIBUTION WIRELESS ACCESS POINT PATCH PANEL (SD-WAPP)."

8. Furnish and install ORTRONICS Part No. OR-PHD68U48 forty-eight (48) port. RJ-45 (568A) type patch panel(s) suitable for rack mounting in the quantity required to cross connect all of the CCTV wiring. Label patch panel as "CCTV CAMERAS”.

9. Furnish and install ORTRONICS Part No. OR-30200145 one hundred (100) pair rack mounted 110 punch down blocks including all necessary mounting hardware in the locations detailed on the Drawings, in the quantity required to terminate all of the 100 pair distribution cables and 4 pair station cables from the RJ-25C ports.

10. The networking sub-distribution frame shall include one (1) rack mounted 110-volt power strip/surge suppressor in each floor-mounted rack. Each power strip/surge suppressor shall consist of eight (8) front mounted outlets, and eight (8) foot long AC power cord. The rack mounted 110-volt power strip/surge suppressor shall be AMERICAN POWER CONVERSION (APC) Part No. AP7900.

11. The networking sub-distribution frame shall have a nameplate of 1/16-inch-thick laminated plastic with 3/16-inch-high white engraved letters on a black background. The nameplate shall identify the frame as indicated on the Drawings and shall be mounted on the front top of the frame.

VI. NETWORKING SPORTS FIELD SUB-DISTRIBUTION FRAME(S) (SDF) **- HIGH SCHOOLS ONLY**

A. This Contractor shall furnish and install where shown on the Drawings, wall mounted networking sports field sub-distribution frame(s) arranged as detailed on the Drawings. Components shall be as shown or equivalent as manufactured by AMP, HUBBELL, P&S ACTIVATES, LEVITON, PANDUIT, or OPTICAL CABLE CORPORATION.

1. Furnish and install ORTRONICS Part No. OR-604004600 heavy duty EIA compliant nineteen (19) inch wide, seven (7) foot tall equipment rack each consisting of fifteen (15) inch self-supporting base; two (2) three (3) inch wide side channels; top angle; and assembly hardware. All components shall have a brushed aluminum finish. Side channels shall be drilled and tapped on both sides.

2. Furnish and install ORTRONICS Part No. OR-FCM-19-2L horizontal cable management modules (CM-1) including all required mounting hardware.

3. Furnish and install light interface unit(s). The unit(s) shall be rack mounted type with a strain bracket for securing cables. A light interface unit, which meets this specification, shall be CORNING Part No. CCH-01U with Two (2) Part No. CCH-CP12-E4 chamber connector panel and part no. 95- 050-99-X type "LC" multimode bulkhead interconnects of the quantity indicated. Other acceptable manufacturers are RADIANT COMMUNICATIONS, FONS, and PASS and SEYMOUR ACTIVATE

4. Furnish and install ORTRONICS Part No. OR-PHD5E8U24 twenty-four (24) port, RJ-45 (568A/B) type patch panel suitable for rack mounting in the quantity required to cross connect all of the telecommunications and/or data only outlet RJ-45 ports.

5. Furnish and install ORTRONICS Part No. OR-PSD5E6U12 twelve (12) port, RJ-45 (568A/B) type patch panel suitable for rack mounting to cross connect all future wireless access point wiring. Label patch panel as "SUB DISTRIBUTION WIRELESS ACCESS POINT PATCH PANEL (SD- WAPP)."

6. Furnish and install ORTRONICS Part No. OR-30200145 one hundred (100) pair rack mounted 110 punch down block with legs including all necessary mounting hardware in the quantity required to terminate all of the 25 pair outside plant distribution cables and 4 pair station cables from the RJ-25C ports.

7. The networking sub-distribution frame shall include one (1) rack mounted 110-volt power strip/surge suppressor in each floor-mounted rack. Each power strip/surge suppressor shall consist of eight (8) front mounted outlets, and eight (8) foot long AC power cord. The rack mounted 110-volt power strip/surge suppressor shall be AMERICAN POWER CONVERSION (APC) Part No. AP7900.

8. The networking sub-distribution frame shall have a nameplate of 1/16-inch-thick laminated plastic with 3/16-inch-high white engraved letters on a black background. The nameplate shall identify the frame as indicated on the

Drawings and shall be mounted on the front top of the frame.

VII. CABLE

A. This Contractor shall furnish and install telecommunications distribution cables as shown on the Drawings and specified herein. The cable shall be UL listed, plenum rated, unshielded, fifty (50) twisted pairs, No. 24 AWG, category 3, UTP/100 type with a flame retardant polyvinyl chloride jacket and a temperature range for dry locations of minus ten (10) degrees C to sixty (60) degrees C. A telecommunications distribution cable, which meets this specification, is BERK- TEK Cat. No. 10032112 or equal as manufactured by AMP, AT&T, BELDEN, THE CABLE COMPANY, GENERAL CABLE, GENISIS, HITACHI, MOHAWK, NORTHERN TELECOM, PAIGE, or OPTICAL CABLE CORPORATION.

B. This Contractor shall furnish and install telecommunications and data only station cables where shown on the Drawings and specified herein. The cable shall be UL listed, plenum rated, unshielded, four (4) twisted pairs, No. 23 AWG, category 6, extended distance, high speed data type with a flame retardant polyvinyl chloride jacket and a temperature range for dry locations of minus ten (10) degrees C to sixty (60) degrees C. A telecommunications cable, which meets this specification, is BERK-TEK Cat. No. 10132983 (Gray) or equal as manufactured by AMP, AT&T, BELDEN, THE CABLE COMPANY, GENERAL CABLE, GENISIS, HITACHI, MOHAWK, NORTHERN TELECOM, PAIGE, or OPTICAL

VIII. CABLE CORPORATION.

A. This Contractor shall furnish and install wireless access point station cable where shown on the Drawings and specified herein. The cable shall be UL listed, plenum rated, unshielded, four (4) twisted pairs, No. 23 AWG, category 6, extended distance, high speed data type with a flame retardant polyvinyl chloride jacket and a temperature range for dry locations of minus ten (10) degrees C to sixty (60) degrees C. A telecommunications cable, which meets this specification, is BERK-TEK Cat. No. 10136749 (Yellow) or equal as manufactured by AMP, AT&T, BELDEN, THE CABLE COMPANY, GENERAL CABLE, GENISIS, HITACHI, MOHAWK, NORTHERN TELECOM, PAIGE, or OPTICAL CABLE CORPORATION.

B. This Contractor shall furnish and install outside plant telecommunications distribution cables (flooded) as shown on the Drawings and specified herein. The cable shall be UL listed, shielded, twenty-five (25) twisted pairs, No. 24 AWG, category 3, UTP/25 type with a temperature range for wet locations and a UV resistant jacket. An outside plant telecommunications distribution cable, which meets this specification, is PAIGE Cat. No. 700190 or equal as manufactured by AMP, AT&T, BELDEN, BERK TEK, THE CABLE COMPANY, GENERAL CABLE, GENISIS, HITACHI, MOHAWK, NORTHERN TELECOM, or OPTICAL CABLE CORPORATION.

C. This Contractor shall furnish and install outside plant telecommunications and data only cables (flooded) as shown on the Drawings and specified herein. The cable shall be UL listed, unshielded, four (4) twisted pairs, No. 23 AWG, category 6, extended distance, high speed data type with a temperature range for wet locations and a UV resistant jacket. An outside plant telecommunications and data only cable, which meets this

specification, is BERK TEK Cat. No. 10139885 or equal as manufactured by AMP, AT&T, BELDEN, THE CABLE COMPANY, GENERAL CABLE, GENISIS, HITACHI, MOHAWK, NORTHERN TELECOM, PAIGE, or OPTICAL CABLE CORPORATION.

D. This Contractor shall furnish and install indoor, plenum rated, fiber optic distribution cables, from Main Distribution Frame (MDF) to Sub Distribution Frame(s) (SDF), in conduit as shown on the Drawings and as specified herein. The cables shall be UL listed, twenty-four (24) strand, tight buffer, 50/125 laser optimized type with a thermoplastic jacket and a temperature range for dry locations of minus forty (40) degrees C to eighty-five (85) degrees C. A fiber optic distribution cable, which meets this specification, is BERK-TEK Part No. PDP024XB3010-X5 or equal as manufactured by AMP, BELDEN, CORNING, GENERAL CABLE, MOHAWK, OPTICAL CABLE CORP., PAIGE, SIECOR, SUMITOMO ELECTRIC, or WEST PENN.

E. This Contractor shall furnish and install outside plant (flooded), indoor/outdoor, plenum rated, fiber optic distribution cables in conduit as shown on the Drawings and as specified herein. The cables shall be UL listed, twenty-four (24) strand, loose tube, 50/125 laser optimized type with dry gel filled tubes and a temperature range for wet or dry locations of minus forty (40) degrees C to seventy-five (75) degrees C. A fiber optic distribution cable, which meets this specification, is BERK-TEK Part No. LTP024XB3010/X5 or equal as manufactured by AMP, BELDEN, CORNING, GENERAL CABLE, MOHAWK, OPTICAL CABLE CORP., PAIGE, SIECOR, SUMITOMO ELECTRIC, or WEST PENN.

F. This Contractor shall furnish and install CCTV camera cables where shown on the Drawings and specified herein. The cable shall be UL listed, plenum rated, unshielded, four (4) twisted pairs, No. 23 AWG, category 6, extended distance, high speed data type with a flame retardant polyvinyl chloride jacket and a temperature range for dry locations of minus ten (10) degrees C to sixty (60) degrees C. A telecommunications cable, which meets this specification, is BERK-TEK Cat. No. 10136748 (Green) or equal as manufactured by AMP, BELDEN, CORNING, GENERAL CABLE, MOHAWK, OPTICAL CABLE CORP., PAIGE, SIECOR, SUMITOMO ELECTRIC, or WEST PENN.

G. Telecommunication’s system service entrance cables shall be furnished and installed by the telephone utility company. It shall be the responsibility of this Contractor to coordinate with the telephone utility to insure timely delivery of permanent telephone service.

IX. LIGHTNING PROTECTION

A. This contractor shall furnish and install for all outside plant telecommunications distribution, telecommunications and data only cables, lightning protection unit(s). The unit(s) shall be located as shown on the drawings and shall be installed no greater than fifty (50) feet from the exterior of the building(s). A Lightning Protection unit, which meets this specification:

1. For telecommunications distribution cables - CIRCA TELECOM Model No. 1880ECA1-25 or approved equal.

2. For Telecommunications and data only cables - CIRCA TELECOM Model No. 1880ENA1/NSC-12 or approved equal.

X. TELEPHONE RINGER BELL/CHIME

A. This contractor shall furnish and install in the kitchen area, one (1) wall mounted bell/chime ringer. The bell/chime ringer shall be connected to telephone ringing voltage circuit of the Kitchen managers telephone located in the kitchen office. Connect to the ringing voltage circuit in strict conformance with the manufacturer's recommendation. A bell/chime that meets this specification is: PRIEMERE Cat. No. PT-400 or equal. Coordinate exact mounting location with Owner.

Part 3 - Execution

I. WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets desks, and counters and except in accessible ceiling spaces, in attics, and in gypsum board partitions where unenclosed wiring method may be use. Conceal raceway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.

2. Comply with requirements for raceways and boxes specified in Division 16 Section "Raceways and Boxes."

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

II. INSTALLATION

A. All fiber optic cable shall be installed in conduit as hereinbefore specified for the entire run. Minimum conduit size for the fiber optic cable shall be ¾" inch.

B. All vertical wiring for the telecommunications system shall be installed by this Contractor in conduit and/or surface metal raceway as shown on the Drawings.

C. All horizontal wiring for the telecommunications system to be installed in areas without a ceiling or in areas without an accessible ceiling shall be installed by this Contractor in 1/2-inch conduit. Conduit is not required in areas designated on the Drawings as "Electric/Communications" rooms or closets.

D. All horizontal wiring for the telecommunications system to be installed in areas with accessible ceilings shall be installed by this Contractor bundled together and run exposed above the ceiling. Bundles shall be supported by "J" hooks mounted not more than four (4) feet on center. "J" hooks to be dedicated to the wiring specified in this specification section.

E. All horizontal wiring for the telecommunications system shall be run at right angles to the building structure.

F. All horizontal wiring for the telecommunications system shall be installed below the roof/floor structural supports (joists, beams, girders, etc.). Wiring installed between the structural supports mentioned above and the roof or floor deck will not be acceptable.

G. All horizontal wiring penetrations for the telecommunications system through new and/or existing walls shall be sleeved. Minimum sleeve size shall be 3/4 inch. All sleeves shall be bushed both sides.

H. All wiring for the telecommunication system in millwork or casework only shall be installed in flexible metal conduit complete with an additional 200-pound pull string.

I. All wiring for the telecommunications system shall be furnished and installed by this Contractor as hereinbefore specified and as showed on the Drawings. All junction box covers shall be stenciled for distinct identification.

J. All wiring connections shall be made by this Contractor as detailed on the Drawings. Cables shall be run free of splices from the equipment enclosures to the telecommunications outlets.

K. All wiring shall be checked and tested by this Contractor to insure the system is free from grounds, opens, and shorts.

L. All wiring installed outside the footprint of a building shall be outside plant (flooded), indoor/outdoor, type cables.

M. All fiber optic outside plant (flooded), indoor/outdoor, type cables shall be installed in min. 3/4” conduit below finished grade with a single No. 10 AWG bare copper conductor. Copper conductor shall run the entire length of the conduit.

III. INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.

2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."

3. Install 110-style IDC termination hardware unless otherwise indicated

4. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.

5. Cables may not be spliced. Secure and support cables at intervals not exceeding 3 inches (760 mm) and not more than 6 inches (150 mm) from

cabinets, boxes, fittings, outlets, racks, frames, and terminals.

6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.

7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.

8. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.

10. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.

11. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2-10.

2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

D. Optical Fiber Cable Installation:

1. Comply with TIA/EIA-568-B.3.

2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

E. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.

2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than [**60 inches (1524 mm)**] apart.

3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

F. Group connecting hardware for cables into separate logical fields.

G. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.

2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

    a) Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).

    b) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).

    c) Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

    a) Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).

    b) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).

    c) Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

    a) Electrical Equipment Rating Less Than 2 kVA: No requirement.

    b) Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).

    c) Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).

6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm)

IV. TELECOMMUNICATIONS OUTLETS

A. This Contractor shall assemble telecommunications outlets and install, connect, and label as shown on the Drawings.

V. RACK MOUNTED EQUIPMENT

A. The networking main distribution frame and the networking sub-distribution frame(s) shall be furnished and installed by this Contractor in the equipment rack(s) as detailed on the Drawings using the proper adapters, rack mounting kits, and brackets. All of this required mounting hardware shall be furnished and installed by this Contractor. All internal wiring shall be labeled, bundled, secured using the cable management modules, and terminated by this Contractor in a neat and professional manner.

B. All frame mounted equipment AC power cords shall be plugged into the adjacent duplex receptacle by the Owner.

VI. WIRELESS ACCESS POINT WIRING

A. All wiring for the wireless access point system shall be terminated in the main and sub distribution frames on the designated wireless access point patch panel(s) as shown on the drawings and herein specified.

B. All wiring for the future wireless access points located in the classrooms, office areas, etc., shall be terminated with a RJ-45 (568A) connector. This contractor shall leave six (6) inches of slack in the wiring for future wireless access point installation.

VII. CCTV WIRING

A. All wiring for the CCTV system shall be terminated in the main and sub distribution frames on the designated CCTV patch panel as shown on the drawings and herein specified.

B. All wiring for the future CCTV camera(s) shall be terminated with a RJ-45 (568A) connector. This contractor shall leave twenty-five (25) feet of slack in the wiring for future CCTV camera installation. Label junction box with the CCTV designation.

VIII. OWNER FURNISHED EQUIPMENT

A. The networking electronic hub equipment and wireless access points shall be furnished and installed by the Owner.

IX. ON-SITE PRECONSTRUCTION MEETING

A. Prior to the beginning of construction, this contractor shall contact Prince George's County Public Schools Office of Safety and Security and schedule a pre-construction meeting to discuss removal and or relocation of any existing CCTV system equipment. This contractor shall not remove or relocate any equipment without first coordinating with the Office of Safety and Security. [NEED NAMES AND PHONE NUMBERS]

X. ON-SITE AS-BUILT DRAWINGS

A. The Contractor shall provide one (1) set of the telecommunications system supplier's as-built drawings for permanent use on-site. The Contractor shall: laminate each page of these drawings; provide a rigid means for mounting such as 1/4-inch-thick x two (2) inch wide x width of the drawings through-bolted wood along the left edge of the drawings; furnish and install hanging hooks on the back of the Communications Room door; and hang the bound set of drawings.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include furnishing and installing a complete bi-directional cable television/broadband distribution system to distribute both analog and digital RF carriers up to a frequency of 860 MHz, utilizing 860 MHz passive and 860 MHz active components and hardware, as shown on the Drawings and herein specified for the distribution of cable television and/or broadband data signals.

B. The cable television/broadband distribution system shall deliver the following minimum performance requirements:

1. Sub-split, (Return): Inbound: 5MHz – 36MHz.

2. Outbound, (Forward): 44 MHz – 860 MHz.

3. Drop cable Outlet Level: + 10dBmv, +/- 5dB.

4. Minimal distribution system Carrier to noise ratio (CNR): 49 dB.

5. Composite Second Order, (CSO), Distortion: 53 dBc or greater.

6. Composite triple Beat, (CTB), Distortion: 53dBc or greater, 49 dBc or greater (HRC & IRC carrier systems).

7. No more than +/- 3.0 dB difference between adjacent channel video carriers.

8. Maximum Outlet Spectral Bandwidth tilt: +/- 10dB on any visual carrier on system up to 300MHz with a +/- 1 dB of separation for every additional 100MHz of total system bandwidth.

9. RF channel Aural carrier level: -15dB below RF channel visual carrier.

10. HUM: Maximum of 3% of visual signal level.

11. RF leakage: per FCC, part 76

C. Cable television service into the building shall be provided by (COX COMMUNICATION) (COMCAST COMMUNICATIONS). It shall be the responsibility of this Contractor to coordinate with the cable television utility to insure timely delivery of permanent cable television service.

D. The cable television head end equipment rack exists and shall be relocated by the Owner.

E. The cable television head-end equipment and cabinet shall be furnished by the Owner and installed by this Contractor as directed by the Owner.

F. The existing cable television/broadband distribution system shall remain in operation throughout the construction period until the new system has been installed and tested, ready for operation. After the new system has become operational, the existing system shall be removed as shown on the Drawings.

III. QUALITY ASSURANCE

A. All active devices for this system shall be listed by Underwriters Laboratories, Inc. (UL), bear the UL label, and shall be installed in accordance with all requirements of the National Electrical Code (NEC), all state and local codes, and these Specifications.

B. Equipment shall be constructed with National Electrical Manufacturer's Association (NEMA) standards.

C. All work relating to the cable television service entrance shall comply with the requirements of the cable television utility company.

D. Shop drawing submittals are required per SECTION 16010 and shall include the following for review. Submittals not containing all of the information listed below will be rejected.

1. Manufacturer's shop drawings for the main and sub-distribution equipment location layouts and equipment.

2. Manufacturer's data sheets for all system components including cables.

3. A detailed set of engineered floor plans for the complete bi-directional system for building shall be furnished showing the locations of all equipment and devices and their required interconnections. The shop drawings shall include the cable path from each wall outlet to its respective main or sub-distribution location. The interconnections shown shall indicate the device designation number, size, type of devices and wires as described in this Specification. The layout of all cable television/broadband distribution system equipment and devices shall include the engineered Db levels at each designated wall outlet as described below in this specification section and shall closely follow that shown on the Drawings.

E. Prior to final inspection, this Contractor shall furnish two (2) complete sets of as- built drawings prepared by mechanical drafting methods. The Drawings shall include: the measured Db level at each outlet on Channel 2 and Channel 9; and the exact locations and descriptions of all outlets, tap equipment, and the like and the location and number of all spare ports.

F. The entire cable television/broadband distribution system installation with the exception of pulling of cable shall be performed by a factory certified installer having a minimum record of five (5) years of successful installations. The installer must show evidence of

successfully furnishing systems specified for at least five (5) years. The installer of the cable television/broadband distribution system shall be named within fourteen (14) days of the bid opening. The contractor shall be prepared, upon the Owners request, to provide proof of factory certifications.

IV. SYSTEM TEST

A. Prior to the final acceptance of each phase of construction and at total completion of project, this Contractor shall conduct an operating test of the complete system. The system must test free from grounds, shorts, and other faults. The system shall provide ten (10) dBmV (+/- 5 dBmV) at each outlet when a signal of 50 DBMV is applied from the headend cable. This Contractor shall inform the Owner of any slope injected into the system during testing. All connections shall be thoroughly checked for mechanical and electrical connections. All equipment shall be demonstrated by this Contractor to operate in accordance with the requirements set forth in these Specifications and shown on the Drawings.

B. This Contractor shall perform all tests in the presence of the Architect/Engineer. This Contractor shall furnish all personnel and test instruments required for use in the test, including signal generator and amplifier. This contractor is not permitted to use building CATV headend equipment for testing purposes.

C. The maximum deviation of drop signals between 50 and 860 MHz (slope) shall not exceed fifteen (15) dBmV. This Contractor shall furnish to the Owner, in the final test documents, the exact slope setting used. Upon request of the owner this contractor shall test the bi-directional system at a maximum of five (5) locations, selected by the owner, to show compliance.

V. WARRANTY

A. This Contractor shall deliver the work described herein in a first class operating condition in every respect. This Contractor shall also warrant that the material, equipment, and workmanship shall be entirely free from defects. Any materials, equipment, or workmanship in which defects may develop before or during the warranty period shall be repaired or replaced at the Contractors own expense. Refer to SECTION 01740 for the start of the warranty period. The contractor shall further warrant that all material, equipment, and workmanship used in the installation, but not specifically mentioned in the Drawings and Specifications, is the best of their respective kinds and that the construction and installation was performed in accordance with the best accepted standard practices in all details.

Part 2 - Products

I. MANUFACTURER

A. The cable television/broadband distribution system equipment shall be manufactured by BLONDER-TONGUE, PPC., PICO MACOM, INC., TONER CABLE EQUIPMENT, INC.

II. EQUIPMENT LOCATIONS

A. This Contractor shall furnish and install where shown on the Drawings, wall mounted main and sub-distribution equipment locations consisting of fire resistant 3/4-inch-thick plywood backboards and the distribution equipment as detailed on the Drawings.

III. MODULAR TAP DEVICES

A. This Contractor shall furnish and install modular tap units in each CATV equipment location as shown on the drawings, in the quantity required to terminate all of the CATV wall outlets. The modular tap units shall consist of the following:

1. Modular tap unit shall have a die cast aluminum housing with six (6) tap cavities for the installation of six (6) plug in tap plates to provide service for up to 48 CATV wall outlets. The housing shall have a cable entry fitting at each end so it can be fed from one end using a terminator plate in the last position or fed from one end with the other end being an output. The modular tap unit shall have a bandwidth of 5 to 1,000 MHz. The modular tap unit shall be TONER CABLE EQUIPMENT, INC., “TOTAL TAP” MODEL No. TXMT-6H with GILBERT ENGINEERING CO., PART No. GF-625-CH KS to F female adaptors.

2. Plug-in tap plates shall have 8 ports each for insertion into the modular tap unit. The tap values of the 8-port plug-in tap plates shall range from 11.5 dB to 26 dB at 5 to 1,000 MHz and shall be selected by this Contractor to meet the test requirements hereinbefore described. The 8-port plug-in tap plates shall be TONER CABLE EQUIPMENT, INC., Model No. TXMT108 series; terminator plates Model No. TXMT108-T series; blank plates Model No. TXMT-B for insertion into unused cavities of the modular tap unit housing; and Equalizer Plates Model No. TXMT- EQ series.

IV. AMPLIFIERS

A. This Contractor shall furnish and install bi-directional, self-attenuating amplifiers as required to complete the system. Amplifiers shall be BLONDER-TONGUE series “5800” and shall have all necessary internal components for a complete bi- directional system. Amplifiers shall only be installed in CATV main and sub- distribution equipment locations.

V. CONNECTORS

A. This contractor shall furnish and install CATV compression type, color coded cable connectors to complete the system. Connectors shall be specifically designed for plenum rated cable. The connectors shall be PPC Model No. EX6, and EX11 as appropriate for RG-6 and RG-11 coaxial cables.

B. The connectors shall be compressed by the appropriate compression tool. The compression tool shall be PPC Model No. VT300 for RG-6 and RG-11 cable.

VI. CABLE TELEVISION/BROADBAND DISTRIBUTION WALL OUTLETS

A. This Contractor shall furnish and install where shown on the Drawings, wall outlets consisting of "F" type connectors complete with stainless steel outlet cover plates. The

cable television/broadband wall outlets shall be TONER CABLE EQUIPMENT, INC., Model No. F-81-NW.

VII. TERMINATORS

A. This Contractor shall furnish and install terminators on all unused female “F” connector jacks throughout the system. The terminator shall be PICO MACOM, INC., Model No. F-59T.

VIII. CABLE

A. This Contractor shall furnish and install all cable television/broadband distribution system zone cables as shown on the Drawings. The cables shall be UL listed, plenum type, coaxial RG-6/U, No. 18 AWG, seventy-five (75) degree C solid bare copper with a maximum resistance of 6.5 ohms per 1,000 feet, foam polyethylene insulation with a tape barrier, and a bifoil (100% coverage) plus an aluminum braid (65% coverage) shield. The television/broadband distribution system zone cable shall be WEST PENN Cat. No. 25841 or equal as manufactured by BELDEN, PAIGE, GENERAL CABLE, or THE CABLE COMPANY.

B. This Contractor shall furnish and install all cable television/broadband distribution system trunk cables as shown on the Drawings. The cables shall be UL listed, plenum type, coaxial RG-11/U, No. 14 AWG, one hundred twenty-five (125) degree C solid bare copper with a maximum resistance of 6.5 ohms per 1,000 feet, foam polyethylene insulation with a tape barrier, and a bifoil (100% coverage) plus an aluminum braid (65% coverage) shield. The television/broadband distribution system trunk cable shall be WEST PENN Cat. No. 25821 or equal as manufactured by BELDEN, GENERAL CABLE, PAIGE, or THE CABLE COMPANY.

C. This Contractor shall furnish and install all outside plant (flooded) cable television/broadband distribution system trunk cables as shown on the Drawings. The cables shall be UL listed, plenum type, coaxial RG-11/U, No. 14 AWG, one hundred twenty-five (125) degree C solid bare copper with a maximum resistance of 11.0 ohms per 1,000 feet, foam polyethylene insulation with a tape barrier, and a bifoil (100% coverage) plus an aluminum braid (61% coverage) shield and flooding. The outside plant (flooded) television/broadband distribution system trunk cable shall be WEST PENN Cat. No. 1110 or equal as manufactured by BELDEN, GENERAL CABLE, PAIGE, or THE CABLE COMPANY.

D. Cable television system service entrance cables shall be furnished and installed by the cable television utility company. It shall be the responsibility of this Contractor to coordinate with the cable television utility to insure timely delivery of permanent cable television service.

IX. MISCELLANEOUS EQUIPMENT

A. This Contractor shall furnish the following items of equipment for installation by the Owner in the headend equipment rack. There shall be no substitutions for this equipment.

1. One (1) BLONDER TONGUE Model No. AM-60-550 w/option 4 Channelized Agile Audio/Video Modulator +60 dBmv, 54-300 MHz complete with ANVIL CASES "Forge II" model carrying case, 20 inches wide x 4-1/2 inches high x 19-1/4 inches deep with handle, removable front and rear, and interior rack mounting rails on the handle end.

X. LABELING

A. This Contractor shall label all cable television/broadband distribution wall outlets as shown on the drawings.

B. This Contractor shall label all cable television/broadband distribution system zone and trunk cables at each main and sub distribution equipment location.

1. Each zone cable shall be clearly labeled with the correct corresponding wall outlet designation. Each zone cable shall be labeled using a labeling machine with minimum ¼" high letters. Each label shall be wrapped around the zone cable and securely fastened.

2. Each trunk cable shall be clearly labeled with the correct corresponding main or sub distribution equipment location. Each trunk cable shall be labeled using a labeling machine with minimum ¼" high letters. Each label shall be wrapped around the trunk cable and securely fastened.

Part 3 - Execution

I. INSTALLATION

A. All cable television/broadband distribution system homerun cables shall be routed from each catv outlet to the main or sub distribution equipment location indicated through the corridors. Routing homerun cables through adjacent spaces is not acceptable.

B. All vertical cable television/broadband distribution system cable shall be installed by this Contractor in conduit and/or surface metal raceway as shown on the Drawings.

C. All horizontal cable television/broadband distribution system cable to be installed in areas without a ceiling or in areas without an accessible ceiling shall be installed by this Contractor in 3/4-inch conduit. Conduit is not required in areas designated on the Drawings as "Electric/Communications" rooms or closets.

D. All horizontal cable television/broadband distribution system cable to be installed in areas with accessible ceilings shall be installed by this Contractor bundled together and run exposed above the ceilings. Bundles shall be supported by "J" hooks mounted not more than four (4) feet on center. "J" hooks to be dedicated to the wiring specified in this specification section.

E. All horizontal cable television/broadband distribution system cable shall be run at right angles to the building structure.

F. All horizontal cable television/broadband distribution system penetrations through new

and/or existing walls shall be sleeved. Minimum sleeve size shall be 3/4 inch. All sleeves shall be bushed both sides.

G. All cable television/broadband distribution system cable shall be terminated and labeled by this Contractor as shown on the Drawings. Cables shall not be nicked, strained, or damaged during the pulling operation. Cables shall be run free of splices from the equipment enclosures to the outlets. All junction box covers shall be stenciled for distinct identification.

H. All cables shall be checked and tested by this Contractor to insure the system is free from grounds, opens, and shorts.

I. This Contractor shall notify the Owner when the service entrance conduit system is complete, ready for installation of the service entrance cable.

J. All work shall be under the direct supervision of a factory accredited engineer. It shall be the responsibility of the Contractor to check and inspect this installation to the Architect/Engineer's approval.

K. This Contractor shall demonstrate, to the Owners technical staff, the ability to properly terminate RG-6 and RG-11 connectors prior to commencement of work.

L. This Contractor shall demonstrate the capabilities of the upstream modulator for up to five (5) locations. The Owner shall select locations. Signal shall be demonstrated to flow back to the headend equipment and then through the entire system for distribution.

M. All wiring installed outside the footprint of a building shall be outside plant (flooded), indoor/outdoor, type cables.

II. WALL MOUNTED EQUIPMENT

III. A. Cable television/broadband distribution system equipment shown on the Drawings or otherwise required to be mounted at a main or sub-distribution equipment location shall be furnished and installed by this Contractor with the proper adapters, mounting kits, and brackets.

A. All equipment enclosure mounted equipment AC power cords shall be plugged into the associated duplex receptacle by this Contractor.

IV. CABLE TELEVISION/BROADBAND DISTRIBUTION OUTLETS

A. This Contractor shall install, connect, and label all cable television/broadband wall outlets, as shown on the Drawings.

V. ON-SITE AS-BUILT DRAWINGS

A. The Contractor shall provide one (1) set of the cable television/broadband distribution system supplier’s as-built drawings for permanent use on-site. The Contractor shall: laminate each page of these drawings; provide a rigid means for mounting such as 1/4-inch thick x two (2) inch wide x width of the drawings through-bolted wood along the left edge of the drawings; furnish and install hanging hooks on the back of the

Communications Room door; and hang the bound set of drawings.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include furnishing and installing a multi-media system as shown on the Drawings and herein specified for the distribution of audio/visual signals from cable television and/or broadband data signals.

III. QUALITY ASSURANCE

A. All active devices for this system shall be listed by Underwriters Laboratories, Inc. (UL), bear the UL label, and shall be installed in accordance with all requirements of the National Electrical Code (NEC), all state and local codes, and these Specifications.

B. Equipment shall be constructed with National Electrical Manufacturer's Association (NEMA) standards.

C. Shop drawing submittals are required per SECTION 16010 and shall include the following for review. Submittals not containing all of the information listed below will be rejected.

1. Manufacturer's data sheets for all system components including cables.

2. A detailed set of engineered floor plans for the complete multi-media system for the building shall be furnished showing the locations of all equipment and devices and their required interconnections. The shop drawings shall be including the cable path from each wall outlet to its respective ceiling outlet location. The interconnections shown shall indicate the device configuration, number, size, type of devices and wires as described in this Specification and detailed on the Drawings. The device locations and wiring shall closely follow that shown on the Drawings.

IV. SYSTEM TEST

A. Prior to the final acceptance of each phase of construction and at total completion of project, this Contractor shall conduct an operating test of the complete system. The system must test free from grounds, shorts, and other faults. All connections shall be thoroughly checked for mechanical and electrical connections.

V. WARRANTY

A. This Contractor shall deliver the work described herein in a first class operating condition in every respect. This Contractor shall also warrant that the material, equipment, and workmanship shall be entirely free from defects. Any materials,

equipment, or workmanship in which defects may develop before or during the warranty period shall be repaired or replaced at the Contractors own expense. Refer to SECTION 01740 for the start of the warranty period. The contractor shall further warrant that all material, equipment, and workmanship used in the installation, but not specifically mentioned in the Drawings and Specifications, is the best of their respective kinds and that the construction and installation was performed in accordance with the best accepted standard practices in all details.

Part 2 - Products

I. MANUFACTURER

A. The multi-media system equipment shall be manufactured by QUICKTRON and PEERLESS or approved equals.

II. MULTI-MEDIA SYSTEM OUTLET, CABLES AND CORD KIT

A. Multi-Media System Outlet and Cable Kit 35 foot: Part number DMVSS35-OP. The Contractor shall furnish and install all multi-media system kits as shown on the Drawings. The outlet and cords shall be UL listed and shall consist of the following:

1. One (1) multi-media system outlet consisting of a single-gang horizontal brushed aluminum faceplate with female HD15, 3.5mm audio, HDMI and USB port.

2. One (1) RAPID RUN Multi-Format Runner Cable, CMP rated, 35 foot in length. Orange identification.

3. One (1) RAPID RUN Optical Runner Cable, CMP rated, 35 foot in length.

4. One (1) RAPID RUN HD15 VGA Flying Lead, 1.5 ft. length, consisting of male HD15 and 3.5mm audio. For connection to Owner furnished Multi- Media device. Orange identification.

5. One (1) RAPID RUN HDMI Optical TX Flying Lead, 4-inch length with 19 inch USB connection. For connection to Owner furnished Multi-Media device. Red identification.

6. One (1) USB 2.0 A/B center boost format, active extension cable. Twelve (12) meters in length.

7. One (1) Flexima HD15 SXGA + 3.5mm patch cable Male/Male, 12 ft in length.

8. High Speed HDMI patch cable, 3 meters in length.

B. Multi-Media System Outlet and Cable Kit 50 foot: Part number DMVSS50-OP. The Contractor shall furnish and install all multi-media system kits as shown on the Drawings. The outlet and cords shall be UL listed and shall consist of the following:

1. One (1) multi-media system outlet consisting of a single-gang horizontal brushed aluminum faceplate with female HD15, 3.5mm audio, HDMI and USB port.

2. One (1) RAPID RUN Multi-Format Runner Cable, CMP rated, 50 foot in length. Orange identification.

3. One (1) RAPID RUN Optical Runner Cable, CMP rated, 50 foot in length.

4. One (1) RAPID RUN HD15 VGA Flying Lead, 1.5 ft. length, consisting of male HD15 and 3.5mm audio. For connection to Owner furnished Multi- Media device. Orange identification.

5. One (1) RAPID RUN Optical HDMI TX Flying Lead, 4-inch length with 19 inch USB connection. For connection to Owner furnished Multi-Media device. Red identification.

6. One (1) USB 2.0 A/B center boost format, active extension cable. Twelve (12) meters in length.

7. One (1) Flexima HD15 SXGA + 3.5mm patch cable Male/Male, 12 ft in length.

8. High Speed HDMI patch cable, 3 meters in length.

III. MULTI – MEDIA CEILING INTERFACE ADAPTOR AND PROJECTOR UNIVERSAL MOUNTING BRACKET

A. This contractor shall furnish and install at each ceiling mounted projector location shown on the Drawings, one (1) lightweight, adjustable, suspended ceiling plate complete with turn buckles, fasteners, escutcheon ring and 1-1/2” diameter extension column. A multi-media ceiling interface adaptor that meets this specification is PEERLESS Model No. CMJ500RI or approved equal. Refer to floor plans for ceiling mounted projector locations.

B. This contractor shall furnish and install at each ceiling mounted projector location shown on the Drawings, one (1) lightweight, adjustable, universal multi-media projector mounting bracket. A universal multi-media projector mounting bracket that meets this specification is PEERLESS Model No. PRG-UNV or approved equal. Refer to floor plans for ceiling mounted projector locations.

Part 3 - Execution

I. INSTALLATION

A. All vertical multi-media system cable shall be installed by this Contractor in conduit and/or surface metal raceway as shown on the Drawings.

B. All horizontal wiring for the multi-media system to be installed in areas without a ceiling or in areas without an accessible ceiling or below finished floor shall be installed by this

Contractor in minimum 1”-inch conduit.

C. All horizontal multi-media system cable to be installed in areas with accessible ceilings shall be installed by this Contractor bundled together and run exposed above the ceilings. Bundles shall be supported by "J" hooks mounted not more than four (4) feet on center. “J” hooks to be dedicated to the wiring specified in this specification section.

D. All horizontal multi-media system cable shall be run at right angles to the building structure.

E. All multi-media system cable shall be terminated and labeled by this Contractor as shown on the Drawings. Cables shall not be nicked, strained, or damaged during the pulling operation. Cables shall be run free of splices. All junction box covers shall be stenciled for distinct identification.

F. All cables shall be checked and tested by this Contractor to insure the system is free from grounds, opens, and shorts.

G. The exact length of the extension column shall be field determined by this contractor prior to installation.

H. This Contractor shall install, Owner furnished, ceiling mounted LCD projector(s). This Contractor shall make all final connections and leave a complete, tested and operational multi-media system.

I. This Contractor shall select a classroom, approved by the owner, to serve as a mock-up/prototype for all LCD projector ceiling mounted installations. This Contractor shall install a typical ceiling mount and LCD projector (LCD projector furnished by owner) to determine the focal length/location and extension column length required. Prior to continuing with the installation(s), coordinate with Owner’s representative for review and approval of installation.

J. This contractor shall install the multi-media cables as indicated for the conditions below. Coordinate the exact installation condition, with the owner, in each area prior to installation:

1. At all ceiling mounted projector locations, install the multi-media cables as follows. The PC runner and HDMI cables shall be extended above the ceiling to the ceiling mounted projector location and connected to the projector with their associated flying leads. The USB active extension cable shall be extended above the ceiling and through the wall mounted Power Column No. 2 to the wall mounted interactive white board and connected to the USB port of the interactive device. Coordinate with Owner prior to installation.

2. At all wall mounted interactive projector locations, install the multi-media cables as follows. The PC runner, USB active extension and HDMI cables shall be extended above the ceiling and through the wall mounted Power Column No. 2 to the wall mounted interactive projector. The PC runner and HDMI cables shall be connected to the interactive device with their associated flying leads. The USB active extension cable shall be connected to the USB port of the interactive projector. Coordinate with Owner prior to installation.

3. At all wall, mounted projector with separate interactive white board locations, install the multi-media cables as follows. The PC runner and HDMI cables shall be extended above the ceiling and through the wall mounted Power Column No. 2 to the wall mounted projector. The PC runner and HDMI cables shall be connected to the projector with their associated flying leads. The USB active extension cable shall be extended above the ceiling and through the wall mounted Power Column No. 2 to the wall mounted interactive white board and connected to the USB port of the interactive device. Coordinate with Owner prior to installation.

4. At all wall mounted flat screen interactive display locations, install the multi-media cables as follows. The PC runner, USB active extension and HDMI cables shall be extended above the ceiling and through the wall mounted Power Column No. 2 to the wall mounted interactive display. The PC runner and HDMI cables shall be connected to the interactive display with their associated flying leads. The USB active extension cable shall be connected to the USB port of the interactive display. Coordinate with Owner prior to installation.

K. All projection and interactive devices are furnished by the Owner, installed by this Contractor. Coordinate with Owner for exact projection and interactive devices to be installed for this project prior to start of work.

II. ON-SITE AS-BUILT DRAWINGS

A. The Contractor shall provide one (1) set of the multi-media system supplier's as-built drawings for permanent use on-site. The Contractor shall: laminate each page of these drawings; provide a rigid means for mounting such as 1/4-inch thick x two (2) inch wide x width of the drawings through-bolted wood along the left edge of the drawings; furnish and install hanging hooks on the back of the Communications Room door; and hang the bound set of drawings.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include furnishing and installing a multi-media presentation control system as shown on the Drawings and herein specified for the distribution of audio/visual signals from cable television and/or broadband data signals.

III. QUALITY ASSURANCE

A. All active devices for this system shall be listed by Underwriters Laboratories, Inc. (UL), bear the UL label, and shall be installed in accordance with all requirements of the National Electrical Code (NEC), all state and local codes, and these Specifications.

B. Equipment shall be constructed with National Electrical Manufacturer's Association (NEMA) standards.

C. Shop drawing submittals are required per SECTION 260500 and shall include the following for review. Submittals not containing all of the information listed below will be rejected.

1. Manufacturer's data sheets for all system components including cables.

2. A detailed set of engineered floor plans for the complete multi-media presentation control system for the building shall be furnished showing the locations of all equipment and devices and their required interconnections. The shop drawings shall be including the cable path from each wall outlet to its respective ceiling outlet location. The interconnections shown shall indicate the device configuration, number, size, type of devices and wires as described in this Specification and detailed on the Drawings. The device locations and wiring shall closely follow that shown on the Drawings.

IV. SYSTEM TEST

A. Prior to the final acceptance of each phase of construction and at total completion of project, this Contractor shall conduct an operating test of the complete system. The system must test free from grounds, shorts, and other faults. All connections shall be thoroughly checked for mechanical and electrical connections.

V. WARRANTY

A. This Contractor shall deliver the work described herein in a first class operating condition in every respect. This Contractor shall also warrant that the material,

equipment, and workmanship shall be entirely free from defects. Any materials, equipment, or workmanship in which defects may develop before or during the warranty period shall be repaired or replaced at the Contractors own expense. Refer to SECTION 01740 for the start of the warranty period. The contractor shall further warrant that all material, equipment, and workmanship used in the installation, but not specifically mentioned in the Drawings and Specifications, is the best of their respective kinds and that the construction and installation was performed in accordance with the best accepted standard practices in all details.

Part 2 - Products

I. MANUFACTURER

A. The multi-media presentation control system equipment shall be manufactured by BTX TECHNOLOGIES, CRESTRON, PEERLESS or approved equals.

II. MULTI-MEDIA PRESENTATION CONTROL SYSTEM

A. MULTI-MEDIA PRESENTATION CONTROL SYSTEM RECEIVER

1. This Contractor shall furnish and install where shown on the Drawings, ceiling mounted multi-media receiver complete with three (3) IM transmitter inputs: XGA resolution up to 84 feet and UXGA up to 34 feet: built-in LAN, RS-232, IR relays and digital input control ports: built-in 20-watt stereo amplifier and line level inputs. A receiver processor that meets this specification is CRESTRON Model No. IM-RXV3-M complete with PW1830RU power supply and MK-IM-RX pole mounting kit or approved equal by EXTRON.

B. MULTI-MEDIA PRESENTATION CONTROL SYSTEM INTERFACE/CONTROL PANEL

1. This Contractor shall furnish and install where shown on the Drawings, wall mounted multi-media control system interface and control panels. The system interface panel shall come complete with: one (1) DB15HD female VGA connection; one (1) 3.5mm mini-jack connector; one (1) RCA-type female connector for composite video input; two (2) RCA-type female connectors for audio composite input. The system control panel shall come complete with a volume control and computer/video source selection button. A multi-media control system interface and control panel that meets this specification is CRESTRON Model No. IM-WCCV -M or approved equal by EXTRON. Where shown on the Drawing to be flush mounted, the devices shall be installed in a three gang, extra deep (min 2.5” depth) device box, refer to floor plans and details.

C. MULTI-MEDIA PRESENTATION CONTROL SYSTEM CABLE

1. This Contractor shall furnish and install all multi-media presentation control system cables as shown on the Drawings. The cables shall be complete with male RJ45 connector at both ends. The cable shall be UL listed, plenum rated, unshielded, four (4) twisted pairs, No. 24 AWG, category 5e with drain wire, extended distance, high speed data type with a flame retardant polyvinyl

chloride jacket and a temperature range for dry locations of minus ten (10) degrees C to sixty (60) degrees C. A multimedia cable, which meets this specification, is CRESTRON, Cat. No. CRESCAT-IM-P-DRN or equal as manufactured by AMP, AT&T, BELDON, BERK-TEK, THE CABLE COMPANY, GENERAL CABLE, GENISIS, HITACHI, MOHAWK, NORTHERN TELECOM, OPTICAL CABLE CORP., or PAIGE.

2. This Contractor shall furnish and install field wiring for multi-media presentation control sound system cables as shown on the Drawings. Wiring shall be two (2) conductor, No. 16 AWG stranded and shielded cable. A cable that meets this Specification is WEST PENN Cat. No.25294B or equal as manufactured by BELDEN, CONSULIDATED WIRE, GENERAL CABLE, PAIGE, or TAPPAN.

D. MULTI-MEDIA PRESENTATION CONTROL SYSTEM PATCH CABLES

1. This Contractor shall furnish and install all multi-media presentation control system patch cables as shown on the Drawings. The cables shall be UL listed, plenum type, and shall consist of the following.

a) One (1) VGA patch cable - BTX Technologies Cat. No. YD-HD15MMT3 or approved equal. Maximum 3 feet length.

b) One (1) composite video cable with RCA male connectors - BTX Technologies Cat. No. YV-RR01 or approved equal. Maximum 12 inches' length.

c) All multi-media system patch cables shall be complete with factory terminated male connectors. Field terminated connectors shall not be acceptable.

III. MULTI – MEDIA CEILING INTERFACE ADAPTOR AND PROJECTOR UNIVERSAL MOUNTING BRACKET

A. This contractor shall furnish and install at each ceiling mounted projector location shown on the Drawings, one (1) lightweight, adjustable, suspended ceiling plate complete with turn buckles, fasteners, escutcheon ring and 1-1/2" diameter extension column. A multi-media ceiling interface adaptor that meets this specification is PEERLESS Model No. CMJ500 or approved equal. Refer to floor plans for ceiling mounted projector locations.

B. This contractor shall furnish and install at each ceiling mounted projector location shown on the Drawings, one (1) lightweight, adjustable, universal multi-media projector mounting bracket. A universal multi-media projector mounting bracket that meets this specification is PEERLESS Model No. PRG-UNV or approved equal. Refer to floor plans for ceiling mounted projector locations.

Part 3 - Execution

I. INSTALLATION

A. All vertical multi-media presentation control system cables shall be installed by this Contractor in conduit and/or surface metal raceway as shown on the Drawings.

B. All horizontal multi-media presentation control system cables to be installed in areas with accessible ceilings shall be installed by this Contractor bundled together and run exposed above the ceilings. Bundles shall be supported by "J" hooks mounted not more than four (4) feet on center. “J” hooks shall be dedicated to the wiring specified in this specification section.

C. All horizontal multi-media presentation control system cables shall be run at right angles to the building structure.

D. All multi-media presentation control system cables shall be terminated and labeled by this Contractor as shown on the Drawings. Cables shall not be nicked, strained, or damaged during the pulling operation. Cables shall be run free of splices. All junction box covers shall be stenciled for distinct identification.

E. All cables shall be checked and tested by this Contractor to insure the system is free from grounds, opens, and shorts.

F. The exact length of the extension column shall be field determined by this contractor prior to installation.

G. This Contractor shall install, Owner furnished, ceiling mounted LCD projector(s). This Contractor shall make all final connections and leave a complete, tested and operational multi-media system.

H. This Contractor shall select a classroom, approved by the owner, to serve as a mock-up/prototype for all LCD projector ceiling mounted installations. This Contractor shall install a typical ceiling mount and LCD projector (LCD projector furnished by Owner) to determine the focal length/location and extension column length required. Prior to continuing with the installation(s), coordinate with Owner’s representative for review and approval of installation.

II. ON-SITE AS-BUILT DRAWINGS

A. The Contractor shall provide one (1) set of the multi-media system supplier’s as- built drawings for permanent use on-site. The Contractor shall: laminate each page of these drawings; provide a rigid means for mounting such as 1/4-inch thick x two (2) inch wide x width of the drawings through-bolted wood along the left edge of the drawings; furnish and install hanging hooks on the back of the Communications Room door; and hang the bound set of drawings.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

B. SCOPE

C. The work covered under this Section shall include furnishing and installing a centrally controlled complete and satisfactorily operating sound and intercommunications system within the building and around the building's perimeter as shown on the Drawings and herein specified for: the pick-up, amplification, reproduction, and distribution of voice and/or music; intercommunications between areas.

D. The existing sound and intercommunications system shall remain in operation during the construction period until the new system has been installed and tested, ready for operation. After the new system has been placed in operation, the existing system shall be removed as shown on the Drawings.

E. All systems shall be complete, including any materials not specifically enumerated herein or shown on the drawings, in order to provide the functions, features, and operations as described. The Contractor is forewarned to confirm product availability with the manufacturer. No claim for payment of additional cost incurred due to discontinued or superseded equipment will be honored.

F. The work covered under this Section shall include furnishing and installing the components only for sound reproduction and reinforcement systems as indicated on the Drawings and described herein.

G. The Sound System Contractor is responsible to coordinate with the Electrical Contractor and verify the existence or impending installation of all conduit, penetrations, backboxes, floorboxes, and electrical circuits in the quantities, sizes, and locations necessary for the system(s) covered herein.

H. System acceptance is contingent upon the Authority’s inspection and verification that all equipment has been provided and that all work, including documentation, has been completed in accordance with the Contract Documents.

II. QUALITY ASSURANCE

A. All equipment described herein shall be the product of a manufacturer of established reputation and experience who shall have produced similar apparatus for a period of at least ten (10) years and who shall be able to, upon request, refer to similar installations now rendering satisfactory service.

B. The sound and intercommunications system shall be furnished by a factory authorized distributor certified to design, program, and service the system. The distributor must show evidence of successfully furnishing systems specified for at least five (5) years

C. All equipment for this system shall be listed by Underwriters Laboratories, Inc. (UL), bear the UL label, and shall be installed in accordance with all requirements of the National Electrical Code (NEC), all state and local codes, and these Specifications.

D. Sound System(s) shall be installed by a separate Sound System Contractor who specializes in this type of work. The Sound System Contractor shall have been a fully licensed business for five (5) years or longer, and shall be able to demonstrate five (5) similar system installations meeting the following requirements:

1. Installed within the last five (5) years.

2. Providing satisfactory service.

3. Within a fifty (50) mile radius of the jobsite

E. All equipment with digital apparatus (microprocessors) that generates and utilizes timing signals at a rate in excess of ten thousand (10,000) pulses per second to compute and operate shall be Federal Communications Commission (FCC) approved. Equipment without the above approval will not be accepted.

F. The entire sound and intercommunications system installation shall be performed under the direct supervision of a factory trained service specialist.

G. Shop drawing submittals are required per SECTION 16010 and shall include the following for review. Submittals not containing all of the information listed below will be rejected.

1. A complete list of equipment shall be furnished indicating the specific quantities to be furnished by the manufacturer. The catalog or model number for each module of the system shall be listed next to the quantities. This shall be provided in the front of the submittal.

2. A specific description of the system shall be furnished describing each module and how it shall function in the system.

3. A detailed set of floor plans for the complete building shall be furnished showing the locations of all equipment, loudspeakers, and devices and their required interconnections. The interconnections shown shall indicate the number, size, and type of wires as described in this Specification. Loudspeakers shall be zoned as shown on the Drawings. The layout of all sound and intercommunications system equipment, and devices, shall closely follow that shown on the Drawings. Electronic microdisks or disquettes containing the building's background (only) will be available from the Architect for this purpose. However, this Contractor will be responsible for maintaining the accuracy of these Drawings.

4. A specific drawing shall be furnished of the main sound equipment rack. Each module shall be shown in its location with its terminal designation shown.

5. A data sheet shall be furnished for each module, component, and device. The information shall be highlighted that applies to the module or device.

6. A detailed diagram on how to connect each device shall be furnished showing exact hook-up information.

III. QUALITY ASSURANCE

A. Conditions for Consideration of "Or Equal" Products: Where products are specified by name and accompanied by the term "or equal", the proposed "or equal" product will be considered when the following conditions are satisfied. If all the following conditions are not satisfied, Design Consultant will return requests without action, except to record noncompliance with these requirements:

1. Proposed product does not require extensive revisions to the Contract Documents.

2. With the exception of the product name or number and manufacturer's name, proposed product conforms with requirements indicated on the Drawings and in the Specifications in every respect and will produce indicated results.

3. Proposed product t is fully documented and properly submitted.

4. Proposed product has received necessary approvals of authorities having jurisdiction.

5. Proposed product is compatible with AND has been coordinated with other portions of the Work.

6. Proposed product provides specified warranty.

7. If proposed product involves more than one contractor, proposed product has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

8. Submission is accompanied with detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.

9. Submission is accompanied with a list of similar installations for completed projects with project names and addresses and names and addresses of design consultants and authorities, if requested.

10. Submission is accompanied with proposed product's Manufacturer signed written statement on Manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents.

IV. DOCUMENTATION

A. This Contractor shall furnish to the Contractor one (2) sets of "As Built" drawings depicting the complete field wiring system and component interconnections in the system equipment rack.

B. This Contractor shall furnish to the Contractor four (4) sets of factory service manuals. These manuals shall include factory service manuals with complete parts lists, wiring and component schematics including circuit diagrams, and other information necessary for the proper operation, service, and maintenance of the system.

C. This Contractor shall furnish to the Owner a typed written sound system zone legend. This legend shall include the following; zone card numbers, default numbers, dial numbers, room locations, comments, ACS, paging zone numbers, mic cable numbers, and zone cable numbers.

V. TRAINING

A. This Contractor shall furnish eight (8) hours of technical service training to the Owner's technical and operating personal i.e., Principal, Vice Principal, Office Secretaries and others that have requirements for operating the system. Operational Training shall be delivered in two (2) four (4) hour sessions scheduled at the Principle's convenience during the warranty period staff using the factory service manuals previously specified.

B. This Contractor shall furnish twenty-four (24) hours of operating and programming training to the Owner's operating staff which shall be delivered in six (6) four (4) hour sessions to be scheduled at the Owner's convenience over the warranty period.

C. All training specified herein shall be performed by a factory certified technician.

VI. DESCRIPTION OF OPERATION

A. This Contractor shall furnish and install a microprocessor controlled voice communication system with all low voltage wiring and equipment as shown on the Drawings and as herein specified to furnish a complete sound, program, distribution, and intercommunication system in the building.

B. System Capacity:

1. It shall be possible to field program any Owner furnished telephone instrument to function as part of the sound and intercommunications system.

2. This Contractor shall furnish and install one (1) desk mounted Administrative Control Station (ACS) in the Communications Room.

3. The system shall provide a minimum of one (1) conversation path for each programmed telephone instrument and/or Administrative Control Station (ACS).

4. Room stations reporting to different programmed telephone instruments and/or an ACS shall be capable of calling simultaneously without interference.

5. Programmed telephone instruments and/or an ACS calling to assigned rooms shall be capable of calling simultaneously without interference.

VII. System Configuration:

1. Programmed telephone instruments and/or an Administrative Control Station (ACS) shall receive calls from classrooms and other indicated areas as shown on the Drawings.

2. Specific classrooms and other areas as shown on the Drawings shall contain a flush wall mounted callback switch to signal the designated programmed telephone instrument and/or ACS.

3. Classrooms, corridors, and other areas as indicated on the Drawings shall contain flush ceiling mounted speakers.

4. Mechanical rooms and other similar type areas, and the building exterior shall contain surface mounted horn type speakers as shown on the Drawings.

5. A hand-held microphone and a flush mounted microphone outlet shall be furnished and installed by this Contractor at the bus loading area as shown on the Drawings. Keying this microphone shall automatically annunciate over the ALL CALL system without the assistance of an operator.

B. Calling sequence of operation:

1. Classroom station calls shall initiate manually a preset status of call to the designated programmed telephone instrument and/or ACS.

2. Programmed telephone instrument and/or ACS to classroom calls shall establish two-way voice communication with classrooms and/or any or all other areas equipped with a loudspeaker.

3. ACS to ACS, or programmed telephone instrument to ACS, or programmed telephone instrument to programmed telephone instrument calls shall establish a two-way telephone conversation.

VIII. SYSTEM OPERATION

A. The system shall allow for user-programmable room number assignment in the form of 3, 4, 5 or 6-digit alphanumeric format for architectural room numbering and a 60-character alpha-numeric caller ID description associated with each audio port.

B. The system shall allow for a minimum of 64 page/time/program zones that can be assigned and configured as desired.

C. The system shall allow for the assigning of each call-in button to one or more of 32 distinct call-in destination groups.

D. The system's administrative telephone shall allow for the user to view the alphanumeric room address and the caller-ID information of the calling station and the call priority (e.g., emergency, normal) on the display. The administrative telephone shall use distinctive ringing patterns to annunciate the type of call.

E. The system shall be capable of receiving 2048 call-ins simultaneously without data collisions or loss of any call-ins. Call-ins shall remain in the system call queue until

answered. Emergency Call-ins shall automatically move to the top of the call-in queue and annunciated in the in-use telephone earpiece to notify the user of an emergency call.

F. The system shall provide priority override capability to all remote independent sound systems (auxiliary, auditorium, gymnasium, etc.) located inside the building. Independent sound systems located outside the building (baseball, football, stadium, etc.) shall not require priority override capabilities.

G. The system shall communicate with each classroom phone. The classroom phone shall be integrated with the classroom speaker. If the staff member or occupant in the classroom lifts the classroom phone while in communication over the classroom loud speaker classroom audio will automatically be transferred to the classroom phone.

H. The system shall contain an integral master clock. The system master clock shall correct secondary clocks, analog or digital or both. The system master clock shall be capable of being synchronized by a Network Time Server (NTP). The system master clock shall provide for automatic daylight saving time adjustment with leap year programming and shall support unlimited schedules with unlimited events on said schedules. The system master clock shall be calendar based capable of future event programming at least 30 years in the future. The system master clock shall allow for scheduling tone events, output events, program source events, and video camera events.

1. The system shall operate under the following audio priority scheme.

a) An emergency page suspends all other audio

b) An emergency tone suspends all other audio except the above

c) A normal page suspends all other audio except the above

d) A tone suspends all other audio except the above

e) A program source audio event suspends nothing

f) Interrupted lower priority functions shall be restored after conclusion of the higher priority function.

I. The system shall allow a call-in to be escalated from a normal call-in to an emergency call-in at any time by pressing the call button twice within 2 seconds.

J. The system shall allow for any connected telephone to place an emergency voice paging announcement.

K. The system shall allow for operation via a GUI based PC based application. The PC application shall allow for emergency paging, normal paging, intercom, activation of any system/user tone, schedule changes, program distribution, call-in management, and on the fly room exclusion.

L. The system shall use a PC based GUI scheduling tool for schedules and tone

management. This tool shall not allow access to any system configuration controls. This tool shall not prevent the system from operating when being used. This tool shall allow the user to schedule events and manage tones over the local LAN/WAN and the Internet. It shall not be required to be directly connected to the central system to use this tool.

M. The system shall have a built in 30-day log of every system function and access.

N. The system shall have a built in real time system diagnostics application.

O. The system shall allow for system diagnostics, system log access firmware updates, and programming over the local LAN/WAN or over the Internet.

IX. SYSTEM TEST AND ACCEPTANCE

A. Prior to the final site visitation, and acceptance of each construction phase, this Contractor shall conduct an operating test of the complete sound and intercommunications systems. The system shall test free from grounds, shorts, and other faults. All connections shall be thoroughly checked for mechanical and electrical connections. All equipment shall be demonstrated to operate in accordance with the requirements set forth in these Specifications and as shown on the Drawings.

B. This Contractor shall perform all tests in the presence of the Architect/Engineer and Owner. This Contractor shall furnish all personnel and test instruments for use in the test.

C. When the work on the entire sound and intercommunications system has been completed and is ready for final review, this Contractor shall demonstrate that the requirements of the Contract as it applies to this work have been carried out and that the system has been adjusted and operated in accordance therewith.

X. EQUIPMENT LOCATIONS

A. This Contractor shall furnish and install where shown on the Drawings, wall mounted main and sub-distribution equipment locations consisting of fire resistant 3/4-inch-thick plywood backboards and the distribution equipment as detailed on the Drawings.

XI. WARRANTY

A. This Contractor shall deliver the work described herein in a first-class operating condition in every respect. This Contractor shall also warrant that the material, equipment, and workmanship furnished shall be entirely free from defects. Any materials, equipment, or workmanship in which defects may develop before or during the warranty period shall be repaired or replaced at the Contractors own expense. Refer to SECTION 01740 for the start of the warranty period. The contractor shall further warrant that all material, equipment, and workmanship used in the installation, but not specifically mentioned in the Drawings and Specifications, is the best of their respective kinds and that the construction and installation was performed in accordance with the best accepted standard practices in all details.

Part 2 - Products

I. General:

A. Equipment included shall meet or exceed all of the features, functions, performance requirements and specifications, outlined herein. Product acceptance as meeting these specifications shall be determined by the Design consultant and Owner. Their decision shall be final.

B. To guarantee to Owner of all factory warranties, all equipment shall be obtained from the Local Factory Authorized Vender/Distributor for the jobsite's geographic location. Vender shall be able to prove this, at the Design consultant/Design consultant's request.

C. Portable Equipment herein referred to shall include any equipment, which may be easily removed from the jobsite. This includes any device with few or no bolt or screw connections and easily disconnected cable terminations.

D. Deliverables or Deliverable Equipment herein referred to shall include any small equipment, which is not physically mounted to the jobsite, or is connected only by a single cable hook-up. This includes any Microphones, Microphone Stands, Patch Cables, Headsets, Phones, etc. Some equipment, or parts of packaged components, is included in this section for simplicity of specification. Where noted these must be installed.

II. MANUFACTURER

A. The sound and intercommunications system shall be the DUKANE "CareHawk" system, or equal as manufactured by RAULAND-BORG or BOGAN (Elementary and Middle Schools Only) system as shown on the Drawings and herein specified. (ENGINEER TO EDIT)

III. ADMINISTRATIVE CONTROL STATION

A. The Administrative Control Station (ACS) shall be desk mounted and contain a matching telephone handset with retractable coiled cord and conductive rubber button switches with clearly designated touch points. The housing shall be constructed of high impact flame-retardant plastic and shall terminate using a RJ- 45 modular telephone type jack. Additional features shall include:

1. Conductive rubber moisture sealed buttons.

2. Twenty (20) character alphanumeric LCD back lit display.

3. Menu driven display.

4. Handset and hands-free intercom with a "Push-to-Talk" button for manual audio direction control in the hands-free mode.

5. Alphanumeric three (3), four (4), or five (5) digit dialing.

6. Distinctive electronic ring signals.

7. Twelve (12) button keypad.

8. SPEAKER PHONE, TALK, ringer VOLUME UP/DOWN, EMERGENCY, TONE, PAGE, PROGRAM, MENU, and eight (8) additional user- programmable special function keys.

9. Telephone type modular connector.

10. Sensitive loudspeaker.

11. Built-in condenser microphone.

12. Queuing.

13. Data communications; local operating networks (LON), RS-485.

14. Telephone style handset with dynamic receiver and electret transmitter.

15. HOLD button.

B. The ACS shall provide the following functions and features.

1. User programmable two, three, four, or five-digit alpha-numeric direct dialing number assignment to the following locations: ACS to classroom speaker(s); ACS to programmed telephone instrument; or ACS to ACS.

2. The ACS shall employ membrane switches that shall provide the user with a positive feel of switch activation.

3. The ACS shall be equipped with a large sixteen (16) character LCD alpha-numeric readout which shall provide the following:

a) Queuing of calling room numbers and telephones.

b) Sequential displays of calls “waiting” with no limit to the number of calls.

c) EMERGENCY, PRIORITY, and NORMAL calls shall be displayed in order received and according to their priority.

d) Display of the alphanumeric room number or location of the calling station.

e) Display of current time in twelve (12) or twenty-four (24) hour format in idle state.

f) Full menu driven display of operator function dialing.

g) Full menu driven display of menu prompting.

C. The ACS shall provide two (2) modes of communication to classroom loudspeakers. Communications shall be via handset or microphone/speaker, activated by a hands-free

speakerphone or built-in talk/listen switch.

D. Answering calls from loudspeaker locations shall be accomplished by picking up the handset or depressing the SPEAKERPHONE button.

E. Call-in from an ACS, programmed telephone instrument, or callback switch shall be displayed in the following manner.

1. The first call entered shall appear in the display window of the ACS that shall display the dial number of the calling station.

2. Any number of calls shall be stored in memory, up to the total capacity of the system with the quantity of those calls waiting displayed at the ACS.

3. NORMAL and lower level calls shall annunciate with slower, repetitive rate, audio tone than EMERGENCY calls. Calls shall sort and stack automatically according to the preprogrammed priority level assignments. Each incoming call shall be automatically registered first in order of priority and then by order placed.

4. Calls that have been upgraded by the caller shall automatically move to the EMERGENCY level and appear in proper sequence.

5. EMERGENCY calls shall be distinguishable from NORMAL calls by designation and unique tone pattern. It shall be possible to visually or audibly determine whether the call-in is an emergency or normal call-in.

6. The ACS shall have the ability to forward its call-in coverage to another ACS or programmed telephone instrument. This shall be a manual operation or at a predetermined time, automatically forwarded.

7. It shall be possible to manually activate and sound the time tone event signal to any of the thirty-two (32) multi-purpose zones from any ACS and/or programmed telephone instrument.

8. The ACS shall include a PROGRAM button for selection and distribution of each of the program channels to loudspeaker zones. The program channels shall be distributed via the ACS to a loudspeaker zones, a group of loudspeaker zones, or all loudspeaker zones. It shall be possible to initiate changes to the distribution of the programs while program distribution is already in progress without having to first defeat the current distribution.

F. The ACS shall be provided with an interconnecting cord set with modular connectors at each end.

G. The system shall provide for transferring a call from the ACS to any other ACS and/or programmed telephone instrument.

H. The system shall be equipped with the necessary ports that shall allow diagnostics via any standard computer terminal and modem interface that shall allow remote engineering assistance from the system manufacturer.

I. The ACS shall provide for review of call-in coverage assignments to an ACS including review of identification numbers of remote stations assigned to either of the two (2) program channels and review of which ACS is forwarding coverage.

J. The System shall, through a standard telephone card, allow for the installation of a standard 1.9 GHz cordless telephone as an ACS.

K. An ACS which will meet this Specification is DUKANE Model No.DA1

IV. CORDLESS ADMINISTRATIVE CONTROL STATION

A. The Administrative Control Station (ACS) shall be desk mounted and contain a matching cordless handset with weatherproof casing, rubber side grips. The unit shall terminate using a RJ-45 modular telephone type jack.

B. Furnish and install one (1) digital waterproof 1.9 GHz cordless ACS. A cordless ACS that meets this specification is a UNIDEN Model No. WXI3077 or approved equal. Install cordless ACS as directed by PGCPS.

V. CENTRAL EQUIPMENT

A. This Contractor shall furnish and install (a) standard nineteen (19) inch wall mounted cabinet(s) for housing the central equipment. The central equipment shall be furnished and installed in the cabinet(s) by this Contractor and shall consist of the following items of equipment in the quantities required to perform the hereinbefore specified functions.

1. Atlas Sound Model No. WMA24-23 wall mounted equipment cabinet. Cabinet shall be complete with locking front door.

2. DUKANE Model No. CH1000-2I-8T Central Controller with two (2) Intercom paths and eight (8) telephone paths.

3. DUKANE Model No. RK100 Rack Mount Kit for the CH1000.

4. The system shall contain natively RS232, RS485, USB and Ethernet ports for communication to any third-party system. The system shall contain five open collectors, three dry contacts, and six general purpose inputs for third party system integration or for general panic buttons. The system shall have integrated surge protection for all audio ports and switching/line card ports.

5. The system shall use class D digital amplifiers(s) with at least 250 Watts RMS and 300 Watts peak output. Amplifier distortion shall not exceed 0.2% at 90% load. The class D amplifier shall be direct drive 25V constant voltage type. The system shall filter all voice signals through a Digital Signal Processor (DSP) to maximize voice intelligibility. System amplifiers shall go to sleep mode thus reducing their current draw when not used and shall have a built in pink noise generators for testing speaker quality and audio levels.

6. The system shall have at least 25 tones available for bells, reminders and other events and shall support WAV type audio files. The user shall be able to add 25+

custom WAV files for use as pre-recorded announcements, bells, reminders, pre-announced tones, or any other system tones.

7. The system shall support remote switching/line cards with 16 and 32 audio ports available Dukane Model No. SS16/SS32. A single central cabinet shall support up to 32 port cards. The remote switching/line cards shall be powered from the central cabinet out to 2700 feet away from the central cabinet.

8. DUKANE Model No. RCD350P AM/FM tuner/CD MP3 player assembly complete with pre-amp, monitor speaker and rack mount kit.

9. Middle Atlantic Model No. PD-920R power panel.

VI. SYSTEM INTEGRITY AND MEMORY

A. The user programmable functions of the sound and intercommunications system shall be protected by a manufacturer supplied lithium battery with a life expectancy of at least ten (10) years.

VII. EQUIPMENT LOCATIONS

A. This Contractor shall furnish and install where shown on the Drawings, wall mounted main and sub-distribution equipment locations consisting of fire resistant 3/4-inch thick plywood backboards.

VIII. ADMINISTRATIVE CONTROL STATION RECEPTACLES

A. This Contractor shall furnish and install where shown on the Drawings, administrative control station receptacles each consisting of: one (1) ORTRONICS Part No. OR-40300549 single-gang faceplate; and one (1) ORTRONICS Part No. OR-TJ5E00- 22 (red) single, category 5e, RJ-45 (568A/B) TrackJack insert suitable for flush or surface mounting in a single-gang outlet box as noted on the Drawings. Faceplate shall be labeled "Sound System Only". The equivalent outlets as manufactured by AMP, HUBBELL, P&S ACTIVATE, LEVITON, OPTICAL CABLE CORP., or PANDUIT, will also be considered provided they are fully equal to the type specified herein.

IX. CLASSROOM CALLBACK SWITCHES

A. This Contractor shall furnish and install where shown on the Drawings, wall mounted callback switches suitable for flush or surface mounting in a single gang outlet box as noted on the Drawings. The call-back switches shall have a call-in push button to provide a method to annunciate a normal intercom call or an emergency intercom call that is received by the DA1 Display Administrative Console. The call switch shall interface with a SS16/SS32 switching card audio port and shall provide RJ45 connectivity for a Cat 6 cable from the SS16/SS32 switching card port. A classroom callback switch that meets this Specification is DUKANE Model No. CS100.

X. FLUSH CEILING MOUNTED SPEAKER ASSEMBLIES

A. This Contractor shall furnish and install where shown on the Drawings, flush 1’x2’ drop-in ceiling speaker assemblies consisting of a loudspeaker, backbox, and baffle. A

flush 1'x2' drop-in ceiling speaker assembly that meets this specification is Quam Model No. System 5 (complete with 2' T-Bar) or equal by Atlas Sound. Each corridor speaker circuit shall have ONE Quam Model. No. System 5/25RSRJ speaker (for the first speaker on the circuit and the closest to the closet) to allow connectivity the SS16/SS32 switching audio ports by using a Cat 6 cable. Corridor circuits shall have maximum FIVE speakers per zone.

B. Flush ceiling mounted speaker assemblies for drywall type ceiling construction shall be the following: Loudspeaker shall be Atlas Sound Model No. C803AT72 or equal by Quam; Baffle shall be Atlas Sound Model No. 51-8 or equal by Quam; Back box shall be Atlas Sound Model No. BMT95-8-7 or equal by Quam for drywall type ceiling installations.

XI. SURFACE CEILING MOUNTED SPEAKER ASSEMBLIES

A. This Contractor shall furnish and install where shown on the Drawings, surface mounted speaker assemblies consisting of an Atlas Sound Model No. C803AT72 loudspeaker and an Atlas Sound Model No. Q428-SA backbox complete with regressed speaker grille and a matte white finish (or equal by Quam).

XII. SURFACE WALL MOUNTED SPEAKER ASSEMBLIES

A. This Contractor shall furnish and install where shown on the Drawings, surface mounted speaker/transformer/baffle assemblies (vandal resistant). With durable 14-gauge steel construction, impermeable security grille, 8" diameter speaker with a frequency response of 50Hz to 18kHz, factory wired 25/70.7-volt transformer with multi power taps. An assembly that meets this specification is Atlas Sound Model No. VP14 or equal by Quam.

XIII. HORN TYPE SPEAKERS

A. This Contractor shall furnish and install where shown on the Drawings, horn type speakers as shown on the Drawings and as herein specified.

B. Horn type speakers shall be wall mounted and have the following characteristics: a full range power rating of 15 watts; frequency response of 275-14,000 Hz; 110-degree dispersion; power taps at 2, 4, 8, and 15 watts; axial sensitivity of 121 dB at 4 feet for 15-watt input; beige baked enamel finish over a corrosion resistant coating; three-way adjustable mounting bracket; and screw type terminals with a transparent cover and strain relief clamp. A horn type speaker that meets this Specification is Atlas model AP-15TC.

C. Horn type speakers for use in gymnasiums shall be surface mounted as shown on the Drawings and shall have the following characteristics: a full range power rating of 30 watts; frequency response of 225-14,000 Hz; 100 degree dispersion; power taps at 2, 4, 8, 15, and 30 watts; axial sensitivity of 125dB at four (4) feet for 30 watt input; beige baked enamel finish over a corrosion resistant coating; three-way adjustable mounting bracket; and screw type terminals with a transparent cover and strain relief clamp. A horn type speaker for use in gymnasiums that meets this Specification is DUKANE Model No. 5A296.

XIV. VOLUME CONTROLS

A. This Contractor shall furnish and install where shown on the Drawings, wall mounted speaker volume controls as specified herein.

B. Volume controls shall provide for control of area speaker volume on 25 volt or 70-volt speaker distribution lines controlling up to 10 watts of audio power. Attenuation shall be accomplished in eleven (11) steps, including "0". The switch shall be a twelve (12) position rotary type. Volume controls shall be complete with a satin finished, stainless steel cover plate and the knob shall have a clearly visible white indicator line. The volume control shall mount in a single gang outlet box, flush or surface mounted as noted on the Drawings. A volume control that meets this Specification is ATLAS SOUDOLIER Model AT-10.

XV. MICROPHONES

A. This Contractor shall furnish one (1) unidirectional, dynamic, dual impedance microphone with the following features: frequency response of 80 to 13,000 Hz; uniform cardioid polar pattern; built-in windscreen; shock mount; on-off switch with lockplate; and swivel adapter. A microphone which meets this Specification is SHURE Model No. SM58S, dynamic cardioid microphones. This microphone shall be furnished by this Contractor complete with a twenty-five (25) foot connector cord with CANNON XLR connectors, and an ATLAS SOUNDOLIER Model MS-20 floor stand.

B. Elementary Schools only: This Contractor shall furnish one (1) bus call station hand-held communications type, noise-canceling, dynamic, noise-canceling microphone with the following features: frequency response of 100 to 7,500 Hz; double pole, double throw touch-to-talk switch with spring return; wall clip; and a six (6) foot long, four (4) conductor cable having two (2) conductors shieA microphone which meets this Specification is ASTATIC Model No. 611L complete with Model No. 40-315 mounting bracket.

XVI. MICROPHONE OUTLETS

A. This Contractor shall furnish and install where shown on the Drawings, wall mounted microphone outlets suitable for flush or surface mounting in a single gang outlet box as noted on the Drawings. Microphone outlets shall consist of CANNON “XLR” series audio jacks of the type required so as to be compatible with the type of microphone cable connector furnished, and a stainless-steel cover plate. A microphone outlet that meets this Specification is Pro Co WP1049DF complete with a five-pin XLR.

XVII. SOUND AND INTERCOMMUNICATIONS SYSTEM CABLE

A. This Contractor shall furnish and install the following cables for each speaker zone shown. One (1) two (2) conductor, twisted shielded pair, No. 18 AWG stranded plenum rated cable with a temperature range for dry locations of minus ten (10) degrees C to sixty (60) degrees C. A cable, which meets this Specification, is WEST PENN Cat. No. 25293B or equal as manufactured by BELDEN, BERK TEK, CONSULIDATED WIRE, and GENERAL CABLE, PAIGE, or TAPPAN.

B. This Contractor shall furnish and install the following cables for each microphone outlet

shown.

1. One (1) stranded, No. 20 AWG, shielded, single twisted pair plenum rated cable with a temperature range for dry locations of minus ten (10) degrees C to sixty (60) degrees C. A cable that meets this Specification is WEST PENN Cat. No. 25292B or equal as manufactured by BELDEN, BERK TEK, CONSULIDATED WIRE, GENERAL CABLE, PAIGE, or TAPPAN.

C. Outside plant (flooded) cable, one (1) two (2) conductor, No. 18 AWG stranded, having two (2) twisted conductors shielded. A cable, which meets this Specification, is WEST PENN Cat. No. AQC293 or equal as manufactured by BELDEN, BERK TEK, CONSULIDATED WIRE, and GENERAL CABLE, PAIGE, or TAPPAN

D. This Contractor shall furnish and install the following cables for each ACS shown.

1. One Cat 6 4-pair UTP Cable, plenum with White Jacket, West Penn Model No. 254246WH or equal as manufactured by BELDEN, BERK TEK, CONSULIDATED WIRE, and GENERAL CABLE, PAIGE, or TAPPAN.

2. This Contractor shall furnish and install the following cables for each callback switch. One Cat 6 4-pair UTP Cable, plenum with White Jacket, West Penn Model No. 254246WH or equal as manufactured by BELDEN, BERK TEK, CONSULIDATED WIRE, and GENERAL CABLE, PAIGE, or TAPPAN.

E. This Contractor shall furnish and install the following cables for each volume control shown.

1. One (1) four (4) conductor, No. 20 AWG stranded plenum rated cables with a temperature range for dry locations of minus ten (10) degrees C to sixty (60) degrees C having two (2) twisted conductors shielded and two (2) twisted conductors unshielded. A cable that meets this Specification is WEST PENN Cat. No. 25359B or equal as manufactured by BELDEN, BERK TEK, CONSULIDATED WIRE, GENERAL CABLE, PAIGE, or TAPPAN.

F. This Contractor shall furnish and install the following cables for priority override for each independent sound system (i.e. auxiliary, auditorium, gymnasium, etc.) within the building.

1. One (1) two (2) conductor No. 14 AWG stranded, plenum rated cable, unshielded (contact or voltage trigger) with a temperature range for dry locations of minus ten (10) degrees C. to sixty (60) degrees C. A cable that meets this specification is WEST PENN Cat. No. 25226B or equal as manufactured by BELDEN, BERK TEK, CONSULIDATED WIRE, and GENERAL CABLE, PAIGE, or TAPPAN (for priority override).

2. One (1) stranded, No. 18 AWG, shielded, single twisted pair, plenum rated (voice) with a temperature range for dry locations of minus ten (10) degrees C. to sixty (60) degrees C. A cable that meets this specification is WEST PENN Cat. No. 25293B or equal as manufactured by BELDEN, BERK TEK, CONSULIDATED WIRE, and GENERAL CABLE, PAIGE, or TAPPAN (for priority override).

G. This Contractor shall furnish and install the following cables for connection between sub-closets and main closet within the building.

1. One Cat 6 4-pair UTP Cable, plenum with White Jacket, West Penn Model No. 254246WH or equal as manufactured by BELDEN, BERK TEK, CONSULIDATED WIRE, and GENERAL CABLE, PAIGE, or TAPPAN (from each SS16/SS32 back to the Central Cabinet plus one additional Cat 6 cable per sub-closet for future spare).

XVIII. AM/FM ANTENNA

A. This Contractor shall furnish and install a PIXEL TECHNOLOGIES Model No. AFHD-4 AM/FM and HD antenna complete with: L mounting bracket; weather boot; surge protector; 20dB attenuator; 10dB attenuator; AM/FM separator; U- bolts with washers and nuts; pole mount saddle brackets; F-female to twin-lead adaptor and push-on-F-female to DIN adaptor. This Contractor shall furnish and install a weatherhead, rigid steel conduit mast, and two (2) RG-6 plenum rated cables from the antennas to the tuner located in the sound and intercommunication system equipment rack. This Contractor shall ground the antenna in accordance with the following specification.

Part 3 - Execution

I. RACK MOUNTED EQUIPMENT

A. Rack mounted equipment shall be installed by this Contractor with the proper adapters, rack mounting kits, brackets, and closure panels for unused spaces. All interconnecting wiring shall be labeled, bundled, secured, and terminated by this Contractor in a neat and professional manner.

B. All rack mounted equipment AC power cords shall be plugged into the mounted power strip by this Contractor.

II. ADMINISTRATIVE CONTROL STATIONS

A. Administrative Control Station (ACS) shall be wired to locations shown on Drawings or described herein by this Contractor and provided with twelve (12) feet of slack cable from the outlet point to the ACS

III. ADMINISTRATIVE TELEPHONE RECEPTACLES

A. Administrative control station receptacles shall be assembled and installed by this Contractor at mounting heights and locations as shown on the Drawings, in outlet boxes appropriate for the location and wire ready for use.

IV. SPEAKERS

A. Flush ceiling mounted speaker assemblies shall be supported by this Contractor from the building structure with a minimum of two (2) steel wires. Ceiling baffles shall be finished flush with the ceiling. The T-Bar shall be securely attached to the ceiling grid

with pop-rivets at both ends. Flush ceiling mounted speakers shall be tapped at 0.5 watts unless otherwise indicated.

B. Surface mounted speaker assemblies shall be securely fastened to the building structure by this Contractor with threaded rod or bolts as appropriate for the application. Surface mounted speakers shall be tapped at 0.5 watts unless otherwise indicated.

C. Surface wall mounted speaker assemblies shall be securely fastened to the building structure by this Contractor with bolts as appropriate for the application. Surface mounted speakers shall be tapped at 4.0 watts unless otherwise indicated.

D. Horn type speaker shall be securely fastened to the building structure by this Contractor with threaded rod, bolts and/or bridging as required for the mounting location. Horn type speakers shall be tapped as directed by the Owner.

V. MICROPHONES

A. This Contractor shall unpack each microphone and assemble with cables and stands and connect ready for operation. Microphones shown for permanent installation shall be mounted by this Contractor in accordance with the Drawings in a manner appropriate for the location.

VI. MICROPHONES OUTLETS

A. This Contractor shall assemble microphone outlets and install, connect, and label as shown on the Drawings.

VII. CALL-BACK SWITCHES

A. Call-back switches shall be installed by this Contractor at mounting heights and locations as shown on the Drawings, in outlet boxes appropriate for the location and wire ready for operation.

VIII. FIELD WIRING

A. All vertical low-voltage field wiring shall be installed by this Contractor in conduit and/or surface metal raceway as shown on the Drawings. Conduit fill shall not exceed the conduit space capacity.

B. All horizontal to be installed in areas without a ceiling or in areas without an accessible ceiling shall be installed by this Contractor in ½-inch conduit. Conduit is not required in areas designed on the Drawings as “Communications” rooms or closets.

C. All horizontal low voltage field wiring to be installed in areas with accessible ceilings shall be installed by this Contractor bundled together and run exposed above the ceilings. Bundles shall be supported by "J" hooks mounted not more than four (4) feet on center. “J” hooks to be dedicated to the wiring specified in this specification section.

D. All horizontal low-voltage field wiring shall be run at right angles to the building structure.

E. All horizontal low voltage field wiring shall be installed below the roof/floor structural supports (joists, beams, girders, etc.). Wiring installed between the structural supports mentioned above and the roof or floor deck will not be acceptable.

F. All horizontal low voltage field wiring penetrations through new and/or existing walls shall be sleeved. Minimum sleeve size shall be 3/4 inch. All sleeves shall be bushed both sides.

G. All low voltage field wiring shall be installed, terminated, and labeled by this Contractor as shown on the Drawings. Cables shall not be nicked, strained, or damaged during the pulling operation. Splices shall be permitted at equipment enclosures and junction boxes only. All splices shall utilize insulated crimp type connectors. All junction box covers shall be stenciled for distinct identification.

H. Microphone cabling shall be installed by this Contractor in accordance with requirements for special cables, however terminations at connectors shall be solder connected.

I. All low voltage wiring shall be checked and tested by this Contractor to insure the system is free from grounds, opens, and shorts.

J. All work shall be under the supervision of a factory accredited sound engineer. It shall be the responsibility of the sound engineer and this contractor to check and inspect this installation to the Owner's and Architect/Engineer's approval.

K. All wiring installed outside the footprint of a building shall be outside plant (flooded), indoor/outdoor, type cables.

IX. ANTENNA INSTALLATION

A. The antenna shall be bracket mounted by this Contractor above the roof at a location approved by the Owner. The antenna cables shall be run by this Contractor to the equipment rack and connected ready for operation.

B. The antenna shall be grounded by this Contractor to the secondary building ground system with one (1) No. 10 AWG in 1/2-inch conduit.

X. ON-SITE AS-BUILT DRAWINGS

A. The Contractor shall provide one (1) set of the sound and intercommunications and system supplier’s as-built drawings for permanent use on-site. The Contractor shall: laminate each page of these drawings; provide a rigid means for mounting such as 1/4-inch-thick x two (2) inch wide x width of the drawings through-bolted wood along the left edge of the drawings; furnish and install hanging hooks on the back of the Communications Room door; and hang the bound set of drawings.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contracts, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include furnishing and installing locally controlled complete and satisfactorily operating auxiliary stereo sound reinforcement systems in the **Cafeteria (Elementary, Middle and High Schools), Gymnasium (Elementary and Middle Schools) and Lecture Halls (Middle and High Schools)** for the pickup, amplification, and reproduction of voice and/or music at a remote location.

B. All systems shall be complete, including any materials not specifically enumerated herein or shown on the drawings, in order to provide the functions, features, and operations as described. The Contractor is forewarned to confirm product availability with the manufacturer. No claim for payment of additional cost incurred due to discontinued or superseded equipment will be honored.

C. The work covered under this Section shall include furnishing and installing the components only for Auxillary Sound reinforcement systems as indicated on the Drawings and described herein.

D. The Sound System Contractor is responsible to coordinate with the Electrical Contractor and verify the existence or impending installation of all conduit, penetrations, backboxes, floorboxes, and electrical circuits in the quantities, sizes, and locations necessary for the system(s) covered herein.

E. System acceptance is contingent upon the Authority's inspection and verification that all equipment has been provided and that all work, including documentation, has been completed in accordance with the Contract Documents.

III. QUALITY ASSURANCE

A. All equipment specified herein shall be the product of a manufacturer of established reputation and experience who shall have produced similar apparatus for a period of at least ten (10) years and who shall be able to refer to similar installations now rendering satisfactory service.

B. The auxiliary sound reinforcement system(s) shall be furnished by a factory authorized distributor certified to design, program, and service the system. The distributor must show evidence of successfully furnishing systems specified for at least five (5) years

C. All equipment for this system shall be listed by Underwriters Laboratories, Inc. (UL), bear the UL label and shall be installed in accordance with all requirements of the National Electrical Code (NEC), state and local codes, and these Specifications.

D. The auxiliary sound reinforcement system(s) shall be furnished and installed by this Contractor as shown on the Drawings and as specified herein.

E. Shop drawing submittals are required per SECTION 16010 and shall include the following for review. Submittals not containing all of the information listed below will be rejected.

1. A complete list of equipment shall be furnished indicating the specific quantities to be furnished by this Contractor. The catalog or model number for each module of the system(s) shall be listed next to the quantities. This information shall be furnished in the front of the submittal.

2. A specific description of the system(s) shall be furnished describing each module and how it shall function in the system.

3. A specific drawing shall be furnished of the (each) equipment rack. Each module shall be shown in its proper location with its terminal designations shown.

4. A data sheet shall be furnished for each module and device. The information shall be highlighted that applies to the particular module or device to be furnished.

5. A detailed diagram showing how to connect each device shall be furnished indicating the exact final connection information.

6. A detailed set of floor plans for the area(s) where the (each) auxiliary sound system(s) is (are) to be installed shall be furnished. The plans shall show the locations of all equipment, loudspeakers, and devices and their required interconnections. The interconnections shown shall indicate the number, size, and type of wires as described in this Specification. Loudspeakers shall be zoned as shown on the Drawings. The layout of all auxiliary sound reinforcement system(s) equipment, devices, and conduit routing shall closely follow that shown on the Drawings.

IV. QUALITY ASSURANCE

A. Conditions for Consideration of "Or Equal" Products: Where products are specified by name and accompanied by the term "or equal", the proposed "or equal" product will be considered when the following conditions are satisfied. If all the following conditions are not satisfied, Design Consultant will return requests without action, except to record noncompliance with these requirements:

1. Proposed product does not require extensive revisions to the Contract Documents.

2. With the exception of the product name or number and manufacturer's name, proposed product conforms with requirements indicated on the Drawings and in the Specifications in every respect and will produce indicated results.

3. Proposed product t is fully documented and properly submitted.

4. Proposed product has received necessary approvals of authorities having jurisdiction.

5. Proposed product is compatible with AND has been coordinated with other portions of the Work.

6. Proposed product provides specified warranty.

7. If proposed product involves more than one contractor, proposed product has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

8. Submission is accompanied with detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.

9. Submission is accompanied with a list of similar installations for completed projects with project names and addresses and names and addresses of design consultants and authorities, if requested.

10. Submission is accompanied with proposed product's Manufacturer signed written statement on Manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents.

V. DOCUMENTATION

A. This Contractor shall furnish to the Contractor, one (1) set of "As Built" drawings depicting the complete field wiring system and component interconnections in the system equipment rack.

B. This Contractor shall furnish to the Contractor four (4) sets of factory operation and maintenance manuals. These manuals shall include factory service manuals with complete parts lists, wiring and component schematics including circuit diagrams, and all other information necessary for the proper operation and service maintenance of the system.

VI. TRAINING

A. This Contractor shall furnish eight (8) hours of technical service training to the Owner's technical staff using the factory operation manuals previously specified.

B. This Contractor shall furnish eight (8) hours of operating and programming training to the Owner's operating staff which shall be delivered in two (2) separate four (4) hour sessions to be scheduled at the Owner's convenience over the warranty period.

C. All training specified herein shall be performed by a factory certified technician.

VII. DESCRIPTION OF OPERATION

A. Each system shall provide for the distribution of voice and music to all associated loudspeakers.

B. Each system shall provide for the reproduction of standard cassette tapes and compact disc recordings and distribute them to all associated loudspeakers.

C. Each system shall provide for the input and output of an external tape recorder.

D. Each system shall provide for individual bass and treble controls.

E. Each system shall provide a personal listening system for use by hearing impaired listeners.

F. Each Auxiliary sound reinforcement system shall accept a priority override signal to mute the system when the main building Sound and Intercommunications System activates the priority override function.

VIII. SYSTEM TEST AND ACCEPTANCE

A. Prior to the final site visitation, and acceptance of each construction phased spaces, this Contractor shall conduct an operating test of each complete auxiliary sound reinforcement system. Each system shall test free from grounds, shorts, and other faults. All connections shall be checked for mechanical and electrical connection. All equipment shall be demonstrated to operate in accordance with the requirements set forth in these Specifications and as shown on the Drawings.

B. This Contractor shall perform all tests in the presence of the Architect/Engineer. This Contractor shall furnish all personnel and test instruments required for use in the test.

IX. WARRANTY

A. This Contractor shall deliver the work described herein in a first class operating condition in every respect. This Contractor shall also warrant that the material, equipment, and workmanship shall be entirely free from defects. Any materials, equipment, or workmanship in which defects may develop before or during the warranty period shall be repaired or replaced at the Contractors own expense. Refer to SECTION 01740 for the start of the warranty period. The contractor shall further warrant that all material, equipment, and workmanship used in the installation, but not specifically mentioned in the Drawings and Specifications, is the best of their respective kinds and that the construction and installation was performed in accordance with the best accepted standard practices in all details.

Part 2 - Products

I. MANUFACTURER

A. The auxiliary sound reinforcement system(s) equipment shall be manufactured by ATLAS SOUND, CROWN, PASO, SHURE, TASCAM and WILLIAMS SOUND as listed.

or equal equipment as manufactured by and RAULAND.

II. AUXILIARY SOUND REINFORCEMENT SYSTEM EQUIPMENT RACKS

A. This Contractor shall furnish and install sectional wall mounted auxiliary sound system equipment racks as shown on the Drawings and herein specified. Each rack shall be ATLAS SOUND Model No. WMA24-23 providing a minimum of forty-two (42) vertical inches of standard nineteen (19) inch wide rack mounting space. Each rack shall be complete with a cylinder lock and textured black finish. Each auxiliary sound system equipment rack shall have a sign mounted to the front stating, “Personal Listening Devices Stored Here”. The sign shall be 1/16-inch-thick laminated plastic with 3/16-inch-high white letters on a black background. The following equipment shall be furnished and installed by this Contractor in each rack:

1. One (1) TOA Model No. D-901 twelve (12) input, eight (8) output, digital mixer. Mixer shall come complete with:

    a) One (1) D936R four (4) stereo input module (tuner, CD, MP3 outlets).

    b) One (1) D971E four (4) channel line output module (personal listening system, amplifier).

    c) Four (4) D921E 2-channel input modules (microphone/MP3 outlets).

2. One (1) TASCAM Model No. CD-200i, rack mounted CD player with MP3 dock.

3. One (1) PYLE Model No. PT504 rack mounted stereo AM/FM tuner.

4. One (1) CROWN Model No. CTs 600 dual channel amplifier with three hundred (300) watts per channel at eight (8) ohms. Amplifier shall be suitable for rack mounting.

5. One (1) ATLAS SOUND Model No. ACS-1 power strip completes with six (6) NEMA 5-15R duplex receptacles and mounting hardware.

6. One (1) WILLIAMS SOUND Model No. PPA T35 personal listening system base station transmitter complete with WILLIAMS SOUND Model No. RPK 005 rack mounting kit and ANT 005 coaxial antenna.

7. This Contractor shall furnish and install in the charging stations thirteen (13) WILLIAMS SOUND Model No. PPA R37, seventeen (17) channel personal listening system receivers each complete with: WILLIAMS SOUND Model No. EAR 013 single earbud, rechargeable batteries, and belt clip.

8. This contractor shall furnish to the owner’s representative, four (4) WILLIAMS SOUND Model NKL 001 neckloops.

9. This Contractor shall furnish and install one (1) WILLIAMS SOUND Model No. CHG 3512 twelve (12) unit charging station and one 3502 two (2) unit charging station for the personal listening system receivers complete with one (1) ATLAS

SOUND Model No. VTD1-16 rack sliding shelf.

10. One (1) SHURE “SLX” series UHF Wireless Microphone System complete with Model No. SLX4 wireless receiver complete with rack mounting hardware and detachable antennas.

III. MICROPHONES

A. This Contractor shall furnish a total of four (4) SHURE Model No. SM58S dynamic cardioid microphones complete with ON-OFF switch and lockplate for each system. Each microphone shall be furnished by this Contractor complete with a twenty-five (25) foot connector cord with CANNON XLR connectors.

B. This Contractor shall furnish to the Owner’s representative, one (1) SHURE Model No. SLX2/SM58 dynamic cardioid wireless handheld microphone, and one (1) SHURE Model No WL183 lapel microphone with SLX1 transmitter. Each complete with an ON/OFF switch and batteries.

IV. MICROPHONE FLOOR STANDS

A. This Contractor shall furnish a total of four (4) ATLAS SOUNDOLIER Model No. MS-20 adjustable microphone floor stands for each system.

V. MICROPHONE OUTLETS

A. This Contractor shall furnish and install where shown on the Drawings, flush or surface wall and/or ceiling mounted microphone outlets (Type “A”) consisting of CANNON "XLR" complete with 3 pin XLR (female) series audio jack of the type required so as to be compatible with the type of microphone cable connector furnished, and a stainless steel cover plate. A microphone outlet, which meets this Specification shall be as manufactured by CONQUEST AUDIO or approved equal.

B. This Contractor shall furnish and install where shown on the Drawings, flush or surface wall mounted Microphone outlets (Type “B”) consisting of one (1) CANNON "XLR", complete with 3 pin XLR (female), series audio jack of the type required so as to be compatible with the type of microphone cable connector furnished, one (1) 3.5mm stereo audio jack (MP3), and a stainless-steel cover plate. A Microphone/MP3 outlet which meets this Specification shall be as manufactured by CONQUEST AUDIO or approved equal.

VI. FLUSH CEILING MOUNTED SPEAKER ASSEMBLIES

A. This Contractor shall furnish and install where shown on the Drawings, flush 1’x2’ drop-in ceiling speaker assemblies consisting of a loudspeaker, backbox, and baffle. A flush 1’x2’ drop-in ceiling speaker assembly that meets this specification is ATLAS SOUND Model No. IS125SYS complete with 2’ T-Bar.

B. Flush ceiling mounted speaker assemblies for drywall type ceiling construction shall be the following: Loudspeaker shall be ATLAS SOUNDOLIER Model No. C803AT72; Baffle shall be ATLAS SOUND Model No. 51-8; Backbox shall be ATLAS SOUND Model No.

95-8 and Model No. 8MT95-8-7 for drywall type ceiling installations.

VII. SURFACE CEILING MOUNTED SPEAKER ASSEMBLIES

A. This Contractor shall furnish and install where shown on the Drawings, surface mounted speaker assemblies consisting of an ATLAS SOUND Model No. C803AT72 loudspeaker and an ATLAS SOUND Model No. Q428-SA backbox complete with regressed speaker grille and matte white finish.

VIII. AM/FM ANTENNA

A. This Contractor shall furnish and install a PIXEL TECHNOLOGIES Model No. AFHD- 4 AM/FM and HD antenna complete with: L mounting bracket; weather boot; surge protector; 20dB attenuator; 10dB attenuator; AM/FM separator; U-bolts with washers and nuts; pole mount saddle brackets; F-female to twin-lead adaptor and push-on-F-female to DIN adaptor. This Contractor shall furnish and install a weatherhead, rigid steel conduit mast, and two (2) RG-6 plenum rated cables from the antennas to the tuner located in the sound and intercommunication system equipment rack. This Contractor shall ground the antenna in accordance with the following specification.

IX. AUXILLARY SOUND SYSTEM CABLE

A. This Contractor shall furnish and install field wiring for auxiliary sound systems loudspeakers as shown on the Drawings. Wiring shall be two (2) conductor, No. 16 AWG stranded and shielded cable. A cable that meets this Specification is WEST PENN Cat. No.25294B or equal as manufactured by BELDEN, CONSULIDATED WIRE, GENERAL CABLE, PAIGE, or TAPPAN.

B. This Contractor shall furnish and install field wiring for microphone outlets as shown on the Drawings. Wiring shall be two (2) conductor, No. 20 AWG stranded and shielded cable. A cable that meets this Specification is WEST PENN Cat. No. 25292B or equal as manufactured by BELDEN, CONSULIDATED WIRE, GENERAL CABLE, PAIGE, or TAPPAN.

C. This Contractor shall furnish and install field wiring for MP3 outlets as shown on the Drawings. Wiring shall be two (2) conductor, No. 20 AWG stranded and shielded cable. A cable that meets this Specification is WEST PENN Cat. No. 25292B or equal as manufactured by BELDEN, CONSULIDATED WIRE, GENERAL CABLE, PAIGE, or TAPPAN.

D. This Contractor shall furnish and install antenna cable consisting of one (1) RG/59U coaxial cable installed by this Contractor in conduit.

E. If required, This Contractor shall furnish and install, for bridge cabling between auxiliary sound systems as shown on the drawings, two (2) conductor, No. 16 AWG stranded and shielded cable. A cable that meets this Specification is WEST PENN Cat. No. 25294B or equal as manufactured by BELDEN, CONSULIDATED WIRE, GENERAL CABLE, PAIGE, or TAPPAN.

Part 3 - Execution

I. EXAMINATION

A. Site Verification of Conditions

1. Examine site conditions, with the Installer present, for compliance with requirements and other conditions affecting the performance of the Integrated Electronic Communications Network system.

2. Do not proceed until unsatisfactory conditions have been corrected.

II. INSTALLATION

A. All vertical low-voltage field wiring shall be installed by this Contractor in conduit and/or surface metal raceway as shown on the Drawings. Conduit fill shall not exceed the conduit space capacity.

B. All horizontal to be installed in areas without a ceiling or in areas without an accessible ceiling shall be installed by this Contractor in ½-inch conduit.

C. All horizontal low voltage field wiring to be installed in areas with accessible ceilings shall be installed by this Contractor bundled together and run exposed above the ceilings. Bundles shall be supported by "J" hooks mounted not more than four (4) feet on center. “J” hooks to be dedicated to the wiring specified in.

D. All low voltage wiring connections shall be made by this Contractor as directed by the manufacturer. Splices for circuits shall be made only in junction boxes and shall be crimp connected.

E. All wiring for the auxiliary sound reinforcement systems shall be checked and tested by this Contractor to insure the system is free from grounds, opens, and shorts.

F. All work shall be under the direct supervision of an accredited factory sound engineer. It shall be the responsibility of the sound engineer and this Contractor to check and inspect this installation to the Architect/Engineer's approval.

G. Flush mounted speaker assembly support bridges shall be supported by this Contractor from the building structure with a minimum of two (2) steel wires. Ceiling baffles shall be finished flush with the ceiling by this Contractor.

H. Surface mounted speakers shall be mounted by this Contractor between bar joists on 1-1/2" x 1-1/2" bridging, flush to the roof deck.

III. RACK MOUNTED EQUIPMENT

A. The auxiliary sound reinforcement system(s) rack mounted equipment shall be installed by this Contractor with the proper adapters, rack mounting kits, brackets, and closure panels for unused spaces. All interconnecting wiring shall be labeled, bundled, secured, and terminated by this Contractor in a neat and professional manner.

B. All rack mounted equipment AC power cords shall be plugged into the mounted power strip by this Contractor.

IV. SPEAKER

A. Flush ceiling mounted speaker assemblies shall be supported by this Contractor from the building structure with a minimum of two (2) steel wires. Ceiling baffles shall be finished flush with the ceiling. The T-Bar shall be securely attached to the ceiling grid with pop-rivets at both ends. Flush ceiling mounted speaker assemblies shall be tapped at 2.0 watts unless otherwise indicated.

B. Surface ceiling mounted speaker assemblies shall be securely fastened to the building structure by this Contractor with threaded rod, bolts and/or bridging as required for the mounting location. Surface ceiling mounted speaker assemblies shall be tapped at 2.0 watts unless otherwise indicated.

V. MICROPHONES

A. This Contractor shall unpack each microphone and assemble with cables and stands and connect ready for operation.

VI. MICROPHONE OUTLETS

A. This Contractor shall assemble microphone outlets and install, connect, and label as shown on the Drawings.

VII. ANTENNA INSTALLATION

A. The antenna shall be bracket mounted by this Contractor above the roof at a location approved by the Owner. The antenna cables shall be run by this Contractor to the equipment rack and connected ready for operation.

B. The antenna shall be grounded by this Contractor to the secondary building ground system with one (1) No. 10 AWG in 1/2-inch conduit.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include furnishing and installing a locally controlled complete and satisfactorily operating sound reinforcement system in the Auditorium for the pickup, amplification, and reproduction of voice and/or music.

III. QUALITY ASSURANCE

A. All equipment described shall be the product of a manufacturer of established reputation and experience produced similar apparatus for a period of at least ten (10) years and shall be able to refer to similar installations now rendering satisfactory service.

B. The auditorium sound reinforcement system shall be furnished by a factory- authorized distributor certified to design, program, and service the system. The distributor must show evidence of successfully furnishing systems specified for at least five (5) years.

C. All equipment for this system shall be listed Underwriters Laboratories, Inc. (UL) bear the UL label and shall be installed in accordance with all requirements of the National Electrical Code (NEC), state and local codes, and these Specifications.

D. The entire Auditorium sound reinforcement system installation shall be performed under the direct supervision of a factory trained service specialist.

E. Shop drawing submittals are required per SECTION 260500 and shall include the following for review. Submittals not containing all of the information listed below will be rejected.

1. A complete list of equipment shall be furnished indicating the specific quantities to be furnished by this Contractor. The catalog or model number for each module of the system shall be listed next to the quantities. This information shall be furnished in the front of the submittal.

2. A specific description of the system shall be furnished describing each module and how it shall function in the system.

3. A specific drawing shall be furnished of the Auditorium sound reinforcement system equipment rack. Each module shall be shown in its proper location with its terminal designation shown.

4. A data sheet shall be furnished for each module and device. The information shall be highlighted that applies to the particular module or device to be furnished.

5. A detailed diagram showing how to connect each device shall be furnished indicating exact final connection information.

6. A detailed drawing showing how to mount the Main House Speakers shall be furnished, including necessary hardware and mounting devices.

7. A detailed floor plan for the Auditorium and associated surrounding areas shall be furnished. The plan shall show the locations of all equipment, loudspeakers, and devices and their required interconnections. The interconnections shown shall indicate the number, size, and type of wires as described in this Specification. Loudspeakers shall be zoned as shown on the Drawings. The layout of all Auditorium sound reinforcement system equipment, devices, and conduit routings shall closely follow that shown on the Drawings.

IV. DOCUMENTATION

A. This Contractor shall furnish to the Contractor, one (1) set of "As Built" drawings depicting the complete field wiring system and component interconnections in the system equipment rack.

B. This Contractor shall furnish to the Contractor, four (4) sets of factory operation and maintenance manuals. These manuals shall include factory service manuals with complete parts lists, wiring and component schematics including circuit diagrams, and all other information necessary for the proper operation, service, and maintenance of the system.

V. TRAINING

A. This Contractor shall furnish eight (8) hours of technical service training to the Owner's technical staff using the factory service manuals previously specified.

B. This Contractor shall furnish eight (8) hours of operating and programming training to the Owner's operating staff which shall be delivered in two (2) separate four (4) hours sessions to be scheduled at the Owner's convenience over the two (2) year warranty period.

C. All training specified herein shall be performed by a factory certified technician.

VI. DESCRIPTION OF OPERATION

A. This Contractor shall furnish and install an Auditorium sound reinforcement system with all conduit, cable, outlets, devices, and equipment as shown on the Drawings and as herein specified to furnish a complete system.

B. The Auditorium sound reinforcement system shall provide for reception of AM or FM radio broadcasts, the amplification of music and voice, and the reproduction of recorded music or other program materials, and their distribution to all associated loudspeakers.

C. The Auditorium sound reinforcement system shall provide a personal listening system

for use by hearing impaired listeners.

D. The Auditorium sound reinforcement system shall also provide for a two (2) channel intercommunications system. The intercommunications system shall provide hands-free, two-way voice communications between areas shown on the Drawings to be equipped with intercommunications system headset outlets.

E. The Auditorium sound reinforcement system shall accept a priority override signal to mute the system when the main building Sound and Intercommunications System activates the priority override function.

VII. SYSTEM TEST AND ACCEPTANCE

A. Prior to the final site visitation this Contractor shall conduct an operating test of the complete Auditorium sound reinforcement system. The system shall test free from grounds, shorts, and other faults. All connections shall be thoroughly checked for mechanical and electrical connections. All equipment shall be demonstrated to operate in accordance with the requirements set forth in these Specifications and as shown on the Drawings.

B. This Contractor shall perform all tests in the presence of the Architect/Engineer. This Contractor shall furnish all personnel and test instruments for use in the test.

C. When the work on entire Auditorium sound reinforcement system has been completed and is ready for final review, this Contractor shall demonstrate that the requirements of the Contract as it applies to this work have been carried out and that the system has been adjusted and operated in accordance therewith.

VIII. WARRANTY

A. This Contractor shall deliver the work described herein in a first-class operating condition in every respect. This Contractor shall also warrant that the material, equipment, and workmanship furnished shall be entirely free from defects. Any materials, equipment, or workmanship in which defects may develop before or during the warranty period shall be repaired or replaced at the Contractors own expense. Refer to SECTION 01740 for the start of the warranty period. The contractor shall further warrant that all material, equipment, and workmanship used in the installation, but not specifically mentioned in the Drawings and Specifications, is the best of their respective kinds and that the construction and installation was performed in accordance with the best accepted standard practices in all details.

Part 2 - Products

I. MAIN EQUIPMENT RACK

A. This Contractor shall furnish and install (a) floor mounted equipment rack(s) for the Auditorium sound reinforcement system as shown on the Drawings and as specified herein. The rack(s) shall be ATLAS SOUND Cat. No. WA200-77B (each) providing a minimum of seventy-seven (77) inches of standard nineteen (19) inch rack mounting space. The rack(s) shall be complete with a hinged front door with cylinder lock and

handle, and a flush spring-hinged rear door with cylinder lock (front and rear locks shall be keyed differently) and handle. Each auditorium sound system equipment rack shall have a sign mounted to the front stating, “Personal Listening Devices Stored Here”. The sign shall be 1/16-inch-thick laminated plastic with 3/16-inch-high white letters on a black background. The rack(s) shall house the following equipment:

1. Four (4) CROWN Model No. CTs3000 dual channel amplifiers, (1500 watts at 8 ohms per channel) one for each main house speaker arrays and one for each main house subwoofer.

2. One (1) CROWN Model No. CTs 600 dual channel amplifier, (300 watts at 8 ohms per channel), for the stage monitor speakers.

3. One (1) PASO Model No. T3115BGM amplifiers with 27/3500 rack mounting kit for the dressing room speakers.

4. One (1) DBX DriveRack 4820 loudspeaker management system.

5. One (1) ATLAS SOUND Model No. MVX-193, monitor panel.

6. One (1) DBX model No. DriveRack 260, digital signal processor with built- in graphic equalizer.

7. One (1) WILLIAMS SOUND Model No. PPA T35 personal listening system base station transmitter complete with WILLIAMS SOUND Model No. RPK 005 rack mounting kit and ANT 005 coaxial antenna.

8. This Contractor shall furnish and install in the charging stations, thirty (30) WILLIAMS SOUND Model No. No. PPA R37, seventeen (17) channel personal listening system receivers each complete with WILLIAMS SOUND Model No. EAR 013 single ear bud, rechargeable batteries, and belt clip.

9. This contractor shall furnish to the owner’s representative, eight (8) WILLIAMS SOUND Model NKL 001 neckloops.

10. This Contractor shall furnish and install, three (3) WILLIAMS SOUND Model No. CHG 3512 twelve (12) unit charging stations for the personal listening system receivers complete with three (3) ATLAS SOUND Model No. VTD1-16 rack sliding shelves.

11. One (1) PYLE Model No. PT504 rack mounted stereo AM/FM tuner.

12. One (1) TASCAM Model No. CD-200i, rack mounted CD player with MP3 dock.

13. One (1) ATLAS SOUND Model No. ACRL-191A AC power control panel suitable for rack mounting.

14. One (1) ATLAS SOUND Model No. ACS-1 AC power strip suitable for rack mounting.

15. One (1) TELEX Model Audiocom MS-2002, rack mounted, two (2) channel intercom master station and power supply.

16. Two (2) Shure ULXD4Q Quad digital receiver, rack mounted four channel microphone receivers complete with two (2) Shure UA8100, 100ft. UHF remote antenna cable and two (2) Shure UA830USTV, In-Line Antenna Amplifiers.

17. One (1) Henry Engineering Model Autoswitch Stereo Audio Switcher for connection to the main school PA/Intercom Emergency Override Function.

II. REMOTE SOUND MIXING EQUIPMENT RACK

A. This Contractor shall furnish and install a floor mounted secure roll-top, semi- portable equipment rack for the remote operation of the sound mixer and peripherals for the Auditorium sound reinforcement system as shown on the Drawings and as specified herein. The rack shall be RAXXESS Cat. No. ERT-ST having all steel construction with two locking pocket doors that cover two 14- space rack bays, locking rear doors and lockable, heavy duty industrial casters. The unit shall have a lockable clear anodized aluminum roll top to secure a sound mixer. The rack shall house the following equipment:

1. One (1) SOUNDCRAFT Model No. GB4, twenty-four (24) channel mixing console.

2. One (1) TASCAM Model No. CD-200i, rack mounted CD player with MP3 dock.

3. One (1) ATLAS SOUND Model no. ACRL-191B AC power control panel suitable for rack mounting.

III. MAIN HOUSE SPEAKER ARRAY

A. This contract shall furnish and install where shown on the Drawings a ceiling mounted speaker array consisting of the following:

1. One (1) JBL Model No. VRX918S18” enclosed, suspended sound reinforcement subwoofer. With a frequency range of 31Hz to 220Hz and a program rating of 1600 watts. The subwoofer shall be complete with mounting hardware and NEUTRIK SPEAKRON connectors.

2. Three (3) JBL Model No. VRX932LA-1 12” two-way constant curvature line array speakers with a frequency range of 57Hz to 20 kHz and a power rating of 1600 watts. The main house speakers shall come complete with mounting hardware and NEUTRIK SPEAKON connectors.

3. One (1) JBL Model No. VRX-AF array mounting bracket.

IV. STAGE MONITOR SPEAKERS

A. This Contractor shall furnish and install where shown on the Drawings, JBL Model No. C29AV-1 eight (8) inch wall mounted stage monitor speakers.

V. DRESSING ROOM FLUSH CEILING MOUNTED STAGE MONITOR SPEAKER ASSEMBLIES

A. This Contractor shall furnish and install where shown on the Drawings, flush 1'x2' drop-in ceiling speaker assemblies consisting of a loudspeaker, back box, and baffle. A flush 1'x2' drop-in ceiling speaker assembly that meets this specification is ATLAS SOUNDOLIER Model No. IS125SYS complete with 2' T-Bar.

VI. DRESSING ROOM SPEAKER VOLUME CONTROLS

A. This Contractor shall furnish and install where shown on the Drawings, ATLAS SOUND Model AT-10.flush or surface (as indicated on the Drawings) wall mounted dressing room speaker volume controls.

VII. MICROPHONES

A. This Contractor shall furnish to the Owner's representative, six (6) SHURE Model No. SM58S dynamic cardioids microphones each complete with an ON/OFF switch. Each microphone shall be furnished by this Contractor complete with a twenty-five (25) foot connector cord with CANNON XLR connectors.

B. This Contractor shall furnish and install six (6) SHURE Model No. MX202B/C hanging microphones at locations shown on the drawings.

C. This Contractor shall furnish and install the following wireless microphones and accessories.

1. Eight (8) Shure ULXD2/SM58 Handheld Transmitter with SM58 capsule.

2. Eight (8) Shure ULXD1 Digital Wireless Body pack.

3. Eight (8) Shure MX1508 Cardioid 5mm subminiature microphone.

4. Two (2) Shure SC800-US, 8-bay Shure Battery Charging Station.

VIII. MICROPHONE STANDS

A. This Contractor shall furnish to the Owner's representative, six (6) ATLAS SOUND Model No. MS-20E microphone floor stands.

B. This Contractor shall furnish to the Owner's representative, six (6) ATLAS SOUND Model No. PB15EB microphone booms.

IX. MICROPHONE OUTLETS

A. This Contractor shall furnish and install where shown on the Drawings, flush or surface wall and/or ceiling mounted microphone outlets (Type "A") consisting of CANNON "XLR" complete with 3 pin XLR (female) series audio jack of the type required so as to be compatible with the type of microphone cable connector furnished, and a stainless-steel cover plate. A microphone outlet, which meets this Specification shall be as manufactured by CONQUEST AUDIO or approved equal.

B. This Contractor shall furnish and install where shown on the Drawings, flush or surface wall mounted Microphone outlets (Type “B”) consisting of one (1) CANNON "XLR", complete with 3 pin XLR (female), series audio jack of the type required so as to be compatible with the type of microphone cable connector furnished, one (1) 3.5mm stereo audio jack (MP3), and a stainless-steel cover plate. A Microphone/MP3 outlet, which meets this Specification shall be as manufactured by CONQUEST AUDIO or approved equal.

C. This Contractor shall furnish and install where shown on the Drawings, flush floor mounted microphone outlets (Type “A”) consisting of a CANNON XLR complete with 3 pin XLR (female) series audio jack of the type required so as to be compatible with the type of microphone cable connector furnished mounted by this Contractor in a MAXICOM "Telematic" floor box with one (1) NEMA 5-20R duplex receptacle (as hereinbefore specified), non-skid top, and tamperproof screws.

X. AM/FM ANTENNA

A. This Contractor shall furnish and install a PIXEL TECHNOLOGIES Model No. AFHD-4 AM/FM and HD antenna complete with: L mounting bracket; weather boot; surge protector; 20dB attenuator; 10dB attenuator; AM/FM separator; U- bolts with washers and nuts; pole mount saddle brackets; F-female to twin-lead adaptor and push-on-F-female to DIN adaptor. This Contractor shall furnish and install a weatherhead, rigid steel conduit mast, and two (2) RG-6 plenum rated cables from the antennas to the tuner located in the sound and intercommunication system equipment rack. This Contractor shall ground the antenna in accordance with the following specification

XI. INTERCOM SUB-STATIONS

A. This Contractor shall furnish and install where shown on the Drawings, TELEX AUDIOCOM Model No. WM-2000 remote headset intercom sub-stations mounted in a two-gang flush or surface wall outlet box as indicated on the Drawings.

XII. INTERCOM HEADSETS

A. This Contractor shall furnish to the Owner’s representative TELEX Model No. PH- 88 single-sided intercom headsets. One (1) headset for every master and sub- station intercom, plus one (1) spare headset.

B. This Contractor shall furnish to the Owner’s representative, six (6) TELEX Model No. HE-15 fifteen (15) foot headset extension cables and two (2) TELEX Model No. HE-30 thirty (30) foot headset extension cables.

XIII. AUDITORIUM SOUND SYSTEM CABLE

A. This Contractor shall furnish and install one (1) two (2) conductor, No. 12 AWG stranded plenum rated cable with a temperature range for dry locations of minus ten (10) degrees C to sixty (60) degrees C for each speaker zone. A cable that meets this Specification is WEST PENN Cat. No. 25227B or equal as manufactured by BELDEN,

CONSULIDATED WIRE, GENERAL CABLE, PAIGE, or TAPPAN.

B. This Contractor shall furnish and install one (1) stranded, No. 18 AWG, shielded, single twisted pair plenum rated cable with a temperature range for dry locations of minus ten (10) degrees C to sixty (60) degrees C for each microphone outlet. A cable that meets this Specification is WEST PENN Cat. No. 25293B or equal as manufactured by BELDEN, CONSULIDATED WIRE, GENERAL CABLE, PAIGE, or TAPPAN.

C. This Contractor shall furnish and install field wiring for MP3 outlets as shown on the Drawings. Wiring shall be two (2) conductor, No. 20 AWG stranded and shielded cable. A cable that meets this Specification is WEST PENN Cat. No. 25292B or equal as manufactured by BELDEN, CONSULIDATED WIRE, GENERAL CABLE, PAIGE, or TAPPAN.

D. This Contractor shall furnish and install two (2) three conductor, No. 18 AWG shielded plenum rated cable with a temperature range for dry locations of minus ten (10) degrees C to seventy-five (75) degrees C for the intercom system. A cable that meets this Specification is WEST PENN Cat. No. 25303 or equal as manufactured by BELDEN, CONSULIDATED WIRE, GENERAL CABLE, PAIGE, or TAPPAN.

Part 3 - Execution

I. INSTALLATION

A. All vertical low voltage field wiring shall be installed by this Contractor in 1/2-inch conduit and/or surface metal raceway as shown on the Drawings. Conduit fill shall not exceed the conduit space capacity.

B. All horizontal low voltage field wiring to be installed in areas without a ceiling or in areas without an accessible ceiling shall be installed by this Contractor in 1/2-inch conduit.

C. All horizontal low voltage field wiring to be installed in areas with accessible ceilings shall be installed by this Contractor bundled together and run exposed above the ceilings. Bundles shall be supported by "J" hooks mounted not more than four (4) feet on center. “J” hooks shall be dedicated to the wiring specified in this specification section.

D. All horizontal low voltage field wiring shall be run at right angles to the building structure.

E. All horizontal low voltage field wiring shall be installed below the roof/floor structural supports (joist, beams, girders, etc.). Wiring installed between the structural supports mentioned above and the roof or floor deck will not be acceptable.

F. All horizontal low voltage field-wiring penetrations through new and/or existing walls shall be sleeved. Minimum sleeve size shall be 3/4 inch. All sleeves shall be bushed both sides.

G. All low voltage field wiring for the Auditorium sound reinforcement system shall be furnished and installed by this Contractor. All junction box covers shall be stenciled for distinct identification.

H. All wiring connections shall be made by this Contractor as directed by the equipment manufacturer. Splices for circuits shall be made only in junction boxes and shall be crimp connected.

I. All Auditorium sound reinforcement system wiring shall be checked and tested by this Contractor to insure the system is free from grounds, opens, and shorts.

J. All work shall be under the supervision of a factory accredited sound engineer. It shall be the responsibility of the sound engineer and this contractor to check and inspect this installation to the Owner's and Architect/Engineer's approval.

II. RACK MOUNTED EQUIPMENT

A. The Auditorium sound reinforcement system's rack mounted equipment shall be installed by this Contractor with the proper adapters, rack mounting kits, brackets, and closure panels for unused spaces. All interconnecting wiring shall be labeled, bundled, secured, and terminated by this Contractor in a neat and professional manner.

B. All rack mounted equipment AC power cords shall be plugged into the mounted power strip by this Contractor.

C. All interconnecting patch cables within equipment rack shall factory manufactured.

D. This contractor shall turn over to the owner all existing wireless microphone rack mounted equipment, microphones and all associated accessories.

III. SPEAKER MOUNTING

A. Ceiling mounted speaker arrays shall be securely fastened to the building structure by this Contractor with threaded rod or bolts as appropriate for the application and in strict conformance with the manufacturer’s recommendations.

B. Surface mounted speakers shall be securely fastened to the building structure by this Contractor with threaded rod or bolts as appropriate for the application and in strict conformance with the manufacturer’s recommendations.

C. Flush ceiling mounted speaker assemblies shall be supported by this Contractor from the building structure with a minimum of two (2) steel wires. Ceiling baffles shall be finished flush with the ceiling. T-Bar type ceiling assemblies also shall be securely attached to the ceiling grid with pop-rivets at both ends. Flush ceiling mounted speaker assemblies shall be tapped at 0.5 watts unless otherwise indicated.

IV. MICROPHONES

A. This Contractor shall unpack microphone and assemble with cables and stands and connect ready for operation. Microphones shown for permanent installation shall be mounted by this Contractor in accordance with the Drawings in a manner appropriate for the location.

V. MICROPHONES OUTLETS

A. This Contractor shall assemble microphone outlets and install, connect, and label as shown on Drawings.

VI. ANTENNA INSTALLATION

A. The antenna shall be bracket mounted by this Contractor above the roof at a location approved by the Owner. The antenna cables shall be run by this Contractor to the equipment rack and connected ready for operation.

B. The antenna shall be grounded by this Contractor to the secondary building ground system with one (1) No. 10 AWG in 1/2-inch conduit.

VII. SPEAKER TESTING AND ADJUSTMENT

A. The main house speaker arrays shall be configured and tested to provide 95 decibels of pink noise with a “C” weighting when measured from the rear seating area of the auditorium.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include furnishing and installing a locally controlled complete and satisfactorily operating sound system in the Black Box Theater for the pickup, amplification, reproduction, and distribution of voice and/or music to associated loudspeakers within the Black Box Theater.

III. QUALITY ASSURANCE

A. All equipment described shall be the product of a manufacturer of established reputation and experience produced similar apparatus for a period of at least ten (10) years and shall be able to refer to similar installations now rendering satisfactory service.

B. The Black Box Theater sound reinforcement system shall be furnished by a factory authorized distributor certified to design, program, and service the system. The distributor must show evidence of successfully furnishing systems specified for at least five (5) years

C. All equipment for this system shall be listed Underwriters Laboratories, Inc. (UL) bear the UL label and shall be installed in accordance with all requirements of the National Electrical Code (NEC), state and local codes, and these Specifications.

D. The entire Black Box Theater sound reinforcement system installation shall be performed under the direct supervision of a factory trained service specialist.

E. Shop drawing submittals are required per SECTION 260500 and shall include the following for review. Submittals not containing all of the information listed below will be rejected.

1. A complete list of equipment shall be furnished indicating the specific quantities to be furnished by this Contractor. The catalog or model number for each module of the system shall be listed next to the quantities. This information shall be furnished in the front of the submittal.

2. A specific description of the system shall be furnished describing each module and how it shall function in the system.

3. A specific drawing shall be furnished of the sound equipment rack. Each module shall be shown in its proper location with its terminal designation shown.

4. A data sheet shall be furnished for each module and device. The information shall be highlighted that applies to the particular module or device to be

furnished.

5. A detailed diagram showing how to connect each device shall be furnished indicating exact final connection information.

6. A detailed floor plan for the Black Box Theater shall be furnished. The plan shall show the locations of all equipment, loudspeakers, and devices and their required interconnections. The interconnections shown shall indicate the number, size, and type of wires as described in this Specification. Loudspeakers shall be zoned as shown on the Drawings. The layout of all Black Box Theater sound system equipment, devices, and conduit routings shall closely follow that shown on the Drawings.

IV. DOCUMENTATION

A. This Contractor shall furnish to the Contractor, one (1) set of "As Built" drawings depicting the complete field wiring system and component interconnections in the system equipment rack.

B. This Contractor shall furnish to the Contractor, four (4) sets of factory operation and maintenance manuals. These manuals shall include factory service manuals with complete parts lists, wiring and component schematics including circuit diagrams, and all other information necessary for the proper operation, service, and maintenance of the Black Box Theater sound reinforcement system.

V. TRAINING

A. This Contractor shall furnish eight (8) hours of technical service training to the Owner's technical staff using the factory service manuals previously specified.

B. This Contractor shall furnish eight (8) hours of operating and programming training to the Owner's operating staff which shall be delivered in two (2) separate four (4) hours sessions to be scheduled at the Owner's convenience over the warranty period.

C. All training specified herein shall be performed by a factory certified technician.

VI. DESCRIPTION OF OPERATION

A. This Contractor shall furnish and install a Black Box Theater sound reinforcement system with all conduit, cable, outlets, devices, and equipment as shown on the Drawings and as herein specified to furnish a complete system.

B. The Black Box Theater sound reinforcement system shall provide for reception of AM or FM radio broadcasts, the amplification of music and voice, and the reproduction of recorded music or other program materials, and their distribution to all associated speakers within the Black Box Theater.

C. The Black Box Theater sound reinforcement system shall accept both the input and output of an external tape recorder.

D. Each Black Box sound reinforcement system shall accept a priority override signal to mute the system when the main building Sound and Intercommunications System activates the priority override function.

VII. SYSTEM TEST AND ACCEPTANCE

A. Prior to the final site visitation this Contractor shall conduct an operating test of the complete Black Box Theater sound reinforcement system. The system shall test free from grounds, shorts, and other faults. All connections shall be thoroughly checked for mechanical and electrical connections. All equipment shall be demonstrated to operate in accordance with the requirements set forth in these Specifications and as shown on the Drawings.

B. This Contractor shall perform all tests in the presence of the Architect/Engineer. This Contractor shall furnish all personnel and test instruments for use in the test.

C. When the work on the entire Black Box Theater sound reinforcement system has been completed and is ready for final review, this Contractor shall demonstrate that the requirements of the Contract as it applies to this work have been carried out and that the system has been adjusted and operated in accordance therewith.

VIII. WARRANTY

A. This Contractor shall deliver the work described herein in a first-class operating condition in every respect. This Contractor shall also warrant that the material, equipment, and workmanship furnished shall be entirely free from defects. Any materials, equipment, or workmanship in which defects may develop before or during the warranty period shall be repaired or replaced at the Contractors own expense. Refer to SECTION 01740 for the start of the warranty period. The contractor shall further warrant that all material, equipment, and workmanship used in the installation, but not specifically mentioned in the Drawings and Specifications, is the best of their respective kinds and that the construction and installation was performed in accordance with the best accepted standard practices in all details.

Part 2 - Products

I. EQUIPMENT RACK

A. This Contractor shall furnish and install where shown on the Drawings, a wall mounted equipment rack for the Black Box Theater sound reinforcement system as specified herein. The rack shall be ATLAS SOUNDOLIER Cat. No. WMA24- 23 sectional, wall mounting type with a textured black finish providing a minimum of sixty-one (61) inches of vertical rack mounting space. The rack shall be complete with a continuous piano hinged front door with a cylinder lock and handle. The following equipment shall be furnished and installed by this Contractor in the rack:

1. One (1) TOA Model No. D-901 twelve (12) input, eight (8) output, digital mixer. Mixer shall come complete with:

a) One (1) D936R four (4) stereo input module (tuner, CD, MP3 outlets).

b) One (1) D971E four (4) channel line output module (personal listening system, amplifier).

c) Four (4) D921E 2-channel input modules (microphone outlets).

2. One (1) Crown Model No. CTs 600 dual channel amplifier with three hundred (300) watts per channel at eight (8) ohms. Amplifier shall be suitable for rack mounting.

3. One (1) TASCAM Model No. CD-200i, rack mounted CD player with MP3 dock.

4. One (1) PYLE Model No. PT504 rack mounted stereo AM/FM tuner.

5. One (1) SHURE “SLX” series UHF Wireless Microphone System complete with Model No. SLX4 wireless receiver complete with rack mounting hardware and detachable antennas.

6. One (1) ATLAS SOUND Model No. ACS-1 AC power strip suitable for rack mounting.

II. WALL MOUNTED STEREO SPEAKERS

A. This contractor shall furnish and install where shown on the Drawings, two (2) JBL Model No “C29AV-1” enclosed wall mounted stereo speakers. The stereo speakers shall be 300 watt, 8 ohms. Each stereo speaker shall be complete with wall mounting bracket.

III. MICROPHONES

A. This Contractor shall furnish to the Owner’s representative, one (1) SHURE Model No. SLX2/SM58S dynamic cardioid wireless handheld microphone, and one (1) SHURE Model No WL183 lapel microphone with SLX1 transmitter. Each complete with an ON/OFF switch and batteries.

B. This Contractor shall furnish to the Owner’s representative, four (4) SHURE Model No. SM58S dynamic cardioid microphones each complete with an ON/OFF switch. Each microphone shall be furnished by this Contractor complete with a twenty-five (25) foot connector cord with CANNON XLR connectors.

IV. MICROPHONE STANDS

A. This Contractor shall furnish to the Owner’s representative, four (4) ATLAS SOUNDOLIER Model No. MS-20 microphone floor stands.

B. This Contractor shall furnish to the Owner’s representative, four (4) ATLAS SOUNDOLIER Model No. PB15CH microphone booms.

V. MICROPHONE OUTLETS

A. This Contractor shall furnish and install where shown on the Drawings, flush or surface wall and/or ceiling mounted microphone outlets (Type “A”) consisting of CANNON "XLR" complete with 3 pin XLR (female) series audio jack of the type required so as to be compatible with the type of microphone cable connector furnished, and a stainless-steel cover plate. A microphone outlet, which meets this Specification shall be as manufactured by CONQUEST AUDIO or approved equal.

B. This Contractor shall furnish and install where shown on the Drawings, flush or surface wall mounted Microphone outlets (Type “B”) consisting of one (1) CANNON "XLR", complete with 3 pin XLR (female), series audio jack of the type required so as to be compatible with the type of microphone cable connector furnished, one (1) 3.5mm stereo audio jack (MP3), and a stainless-steel cover plate. A Microphone/MP3 outlet, which meets this Specification shall be as manufactured by CONQUEST AUDIO or approved equal.

VI. AM/FM ANTENNA

A. This Contractor shall furnish and install a PIXEL TECHNOLOGIES Model No. AFHD-4 AM/FM and HD antenna complete with: L mounting bracket; weather boot; surge protector; 20dB attenuator; 10dB attenuator; AM/FM separator; U- bolts with washers and nuts; pole mount saddle brackets; F-female to twin-lead adaptor and push-on-F-female to DIN adaptor. This Contractor shall furnish and install a weatherhead, rigid steel conduit mast, and two (2) RG-6 plenum rated cables from the antennas to the tuner located in the sound and intercommunication system equipment rack. This Contractor shall ground the antenna in accordance with the following specification.

VII. BLACK BOX THEATER SOUND SYSTEM CABLE

A. This Contractor shall furnish and install one (1) two (2) conductor, No. 12 AWG stranded plenum rated cable with a temperature range for dry locations of minus ten (10) degrees C to sixty (60) degrees C for each stereo speaker. A cable that meets this Specification is WEST PENN Cat. No. 25227B or equal as manufactured by BELDEN, CONSULIDATED WIRE, GENERAL CABLE, PAIGE, or TAPPAN.

B. This Contractor shall furnish and install one (1) stranded, No. 20 AWG, shielded, single twisted pair plenum rated cable with a temperature range for dry locations of minus ten (10) degrees C to sixty (60) degrees C for each microphone outlet. A cable that meets this Specification is WEST PENN Cat. No. 25292B or equal as manufactured by BELDEN, CONSULIDATED WIRE, GENERAL CABLE, PAIGE, or TAPPAN.

Part 3 - Execution

I. INSTALLATION

A. All vertical low voltage field wiring shall be installed by this Contractor in 1/2-inch conduit and/or surface metal raceway as shown on the Drawings. Conduit fill shall not exceed the conduit space capacity.

B. All horizontal, low voltage field wiring to be installed in areas without a ceiling or in areas without an accessible ceiling shall be installed by this Contractor in 1/2-inch conduit.

C. All horizontal, low voltage field wiring to be installed in areas with accessible ceilings shall be installed by this Contractor bundled together and run exposed above the ceilings. Bundles shall be supported by "J" hooks mounted not more than four (4) feet on center. “J” hooks shall be dedicated to the wiring specified in this specification section.

D. All horizontal, low voltage field wiring shall be run at right angles to the building structure.

E. All horizontal, low voltage field wiring shall be installed below the roof/floor structural supports (joists, beams, girders, etc.). Wiring installed between the structural supports mentioned above and the roof or floor deck will not be acceptable.

F. All horizontal, low voltage field wiring penetrations through new and/or existing walls shall be sleeved. Minimum sleeve size shall be 3/4 inch. All sleeves shall be bushed both sides.

G. All low voltage field wiring for the Black Box Theater sound reinforcement system shall be furnished and installed by this Contractor. All junction box covers shall be stenciled for distinct identification.

H. All wiring connections shall be made by this Contractor as directed by the equipment manufacturer. Splices for circuits shall be made only in junction boxes and shall be crimp connected.

I. All Black Box Theater sound reinforcement system wiring shall be checked and tested by this Contractor to insure the system is free from grounds, opens, and shorts.

J. All work shall be under the supervision of a factory accredited sound engineer. It shall be the responsibility of the sound engineer and this contractor to check and inspect this installation to the Owner's and Architect/Engineer's approval.

II. RACK MOUNTED EQUIPMENT

A. The Black Box Theater sound system's rack mounted equipment shall be installed by this Contractor with the proper adapters, rack mounting kits, brackets, and closure panels for unused spaces. All interconnecting wiring shall be labeled, bundled, secured, and terminated by this Contractor in a neat and professional manner.

B. All rack mounted equipment AC power cords shall be plugged into the mounted power strip by this Contractor.

III. SPEAKER

A. Wall mounted stereo speakers shall be securely fastened to the building structure by this Contractor with threaded rod or bolts as appropriate for the application.

IV. MICROPHONES

A. This Contractor shall unpack microphone and assemble with cables and stands and connect ready for operation. Microphones shown for permanent installation shall be mounted by this Contractor in accordance with the Drawings in a manner appropriate for the location.

V. MICROPHONES OUTLETS

A. This Contractor shall assemble microphone outlets and install, connect, and label as shown on Drawings.

VI. ANTENNA INSTALLATION

A. The antenna shall be bracket mounted by this Contractor above the roof at a location approved by the Owner. The antenna cables shall be run by this Contractor to the equipment rack and connected ready for operation.

B. The antenna shall be grounded by this Contractor to the secondary building ground system with one (1) No. 10 AWG in 1/2-inch conduit.

END OF SECTION

Part 1 - General

I. REQUIREMENT

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include furnishing and installing a locally controlled complete and satisfactorily operating system for the pickup, amplification, reproduction, and distribution of voice and/or music to loudspeakers within the Gymnasium as shown on the Drawings and herein specified.

III. QUALITY ASSURANCE

A. All equipment described shall be the product of a manufacturer of established reputation and experience producing similar apparatus for a period of at least ten (10) years and shall be able to refer to similar installations now rendering satisfactory service.

B. The Gymnasium sound reinforcement system shall be furnished by a factory authorized distributor certified to design, program, and service the system. The distributor must show evidence of successfully furnishing systems specified for at least five (5) years.

C. All equipment for this system shall be listed by Underwriters Laboratories, Inc. (UL), bear the UL label, and shall be installed in accordance with all requirements of the National Electrical Code (NEC), state and local codes, and these Specifications.

D. The entire Gymnasium sound reinforcement system installation shall be performed under the direct supervision of a factory trained service specialist.

E. Shop drawing submittals are required per SECTION 260500 and shall include the following for review:

1. A complete list of equipment shall be furnished indicating the specific quantities to be furnished by the manufacturer. The catalog or model number for each module of the system shall be listed next to the quantities. This information shall be furnished in the front of the submittal.

2. A specific description of the system shall be furnished describing each module and how it shall function in the system.

3. A detailed floor plan of the Gymnasium area shall be furnished showing the locations of all equipment, loudspeakers, and devices and their required interconnections. The interconnections shown shall indicate the number, size, and type of cable as described in this Specification. The layout of all Gymnasium sound reinforcement system equipment, devices, and conduit routings shall closely follow that shown on the Drawings.

4. A specific drawing of the Gymnasium sound reinforcement system rack shall be made by the equipment supplier. Each module shall be shown in its proper location with its terminal designation shown.

5. A data sheet shall be furnished for each module and device. The information shall be highlighted that applies to the particular module or device to be furnished.

6. A detailed diagram showing how to connect each device shall be furnished indicating exact final connection information.

7. A detailed drawing showing how to mount the Gymnasium speakers shall be furnished, including necessary hardware and mounting devices.

IV. DOCUMENTATION

A. This Contractor shall furnish to the Contractor, one (1) set of "As Built" drawings depicting the complete field wiring system and component interconnections in the Gymnasium sound reinforcement system equipment rack.

B. This Contractor shall furnish to the Contractor, four (4) sets of factory operation and maintenance manuals. These manuals shall include factory service manuals with complete parts lists, wiring and component schematics including circuit diagrams, and all other information necessary for the proper operation, service, and maintenance of the Gymnasium sound reinforcement system.

V. TRAINING

A. This Contractor shall furnish eight (8) hours of technical service training to the Owner's technical staff using the factory operation manuals previously specified.

B. This Contractor shall furnish eight (8) hours of operating and programming training to the Owner's operating staff which shall be delivered in two (2) separate four (4) hour sessions to be scheduled at the Owner's convenience over the warranty period.

C. All training specified herein shall be performed by a factory certified technician.

VI. DESCRIPTION OF OPERATION

A. This Contractor shall furnish and install a Gymnasium sound reinforcement system with all cable and equipment as shown on the Drawings and as herein specified to furnish a complete system.

B. The Gymnasium sound reinforcement system shall provide for the reception of AM or FM radio broadcasts, the amplification of music and/or voice, and the reproduction of recorded music or other program materials, and their distribution to all associated loudspeakers.

C. The Gymnasium sound reinforcement system shall provide a personal listening system for use by hearing impaired listeners.

D. Each Gymnasium sound reinforcement system shall accept a priority override signal to mute the system when the main building Sound and Intercommunications System activates the priority override function.

VII. SYSTEM TEST AND ACCEPTANCE

A. Prior to the final site visitation this Contractor shall conduct an operating test of the complete Gymnasium sound reinforcement system. The system shall test free from grounds, shorts, and other faults. All connections shall be thoroughly checked for mechanical and electrical connections. All equipment shall be demonstrated to operate in accordance with the requirements set forth in these Specifications and as shown on the Drawings.

B. This Contractor shall perform all tests in the presence of the Architect/Engineer. This Contractor shall furnish all personnel and test instruments for use in the test.

C. When the work on the entire Gymnasium sound reinforcement system has been completed and is ready for final review, this Contractor shall demonstrate that the requirements of the Contract as it applies to this work have been carried out and that the system has been adjusted and operated in accordance therewith.

VIII. WARRANTY

A. This Contractor shall deliver the work described herein in a first-class operating condition in every respect. This Contractor shall also warrant that the material, equipment, and workmanship furnished shall be entirely free from defects. Any materials, equipment, or workmanship in which defects may develop before or during the warranty period shall be repaired or replaced at the Contractors own expense. Refer to SECTION 01740 for the start of the warranty period. The contractor shall further warrant that all material, equipment, and workmanship used in the installation, but not specifically mentioned in the Drawings and Specifications, is the best of their respective kinds and that the construction and installation was performed in accordance with the best accepted standard practices in all details.

Part 2 - Products

I. EQUIPMENT RACK

A. This Contractor shall furnish and install where shown on the Drawings, a wall mounted equipment rack for the Gymnasium sound reinforcement system as specified herein. The rack shall be ATLAS SOUND Cat. No. WMA35-23 sectional wall mounting type with a textured black finish providing a minimum of thirty-five (35) vertical rack units of mounting space. The rack shall be complete with a continuous piano hinged front door with a cylinder lock and handle. The gymnasium sound system equipment rack shall have a sign mounted to the front stating, “Personal Listening Devices Stored Here”. The sign shall be 1/16-inch-thick laminated plastic with 3/16-inch-high white letters on a black background. The following equipment shall be furnished and installed by this Contractor in the rack:

1. Two (2) dual channel power amplifiers with a minimum rating of 600 watts' continuous sine wave per channel into an eight (8) ohm output at twenty (20) Hz to twenty (20) kHz with a maximum 0.1 percent (0.1%) distortion. A power amplifier that will meet this Specification is CROWN Model No. CTs 1200.

2. One (1) TOA Model No. D-901 twelve (12) input, eight (8) output, digital mixer. Mixer shall come complete with:

    a) One (1) D936R four (4) stereo input module (tuner, CD, MP3 outlets).

    b) One (1) D971E four (4) channel line output module (personal listening system, amplifier).

    c) Four (4) D921E 2-channel input modules (microphone outlets).

3. One (1) PYLE Model No. PT504 rack mounted stereo AM/FM tuner.

4. One (1) TASCAM Model No. CD-200i, rack mounted CD player with MP3 dock.

5. One (1) WILLIAMS SOUND Model No. PPA T35 personal listening system base station transmitter complete with WILLIAMS SOUND Model No. RPK 005 rack mounting kit and ANT 005 coaxial antennae.

6. This Contractor shall furnish and install in the charging stations, thirty-two (32) WILLIAMS SOUND Model No. No. PPA R37, seventeen (17) channel personal listening system receivers each complete with WILLIAMS SOUND Model No. EAR 013 single ear bud, rechargeable batteries, and belt clip.

7. This contractor shall furnish to the owners representative, eight (8) WILLIAMS SOUND Model NKL 001 neckloops.

8. This Contractor shall furnish and install, three (3) WILLIAMS SOUND Model No. CHG 3512 twelve (12) unit charging stations for the personal listening system receivers complete with three (3) ATLAS SOUND Model No. VTD1-16 rack sliding shelves.

9. One (1) SHURE "SLX" series UHF Wireless Microphone System complete with Model No. SLX4 wireless receiver complete with rack mounting hardware and detachable antennas

10. One (1) ATLAS SOUND Model No. RAC-9 AC power strip suitable for rack mounting.

II. SPEAKER SYSTEMS

A. This Contractor shall furnish and install where shown on the Drawings 2-way loudspeakers (number as shown on drawings) with a frequency response of 90 Hz - 16 kHz and shall include drivers. The speakers shall be COMMUNITY Model No. R5.99 complete with COMMUNITY mounting yoke kit and ATM PM-Series pole mounts where required or equal as manufactured by JBL.

III. MICROPHONES

A. This Contractor shall furnish to the Owner's representative, four (4) SHURE Model No. SM58S dynamic cardioid microphones. Each complete with an ON/OFF switch. Each microphone shall be furnished by this Contractor complete with a twenty-five (25) foot connector cord with CANNON XLR connectors

B. This Contractor shall furnish to the Owner's representative, one (1) SHURE Model No. SLX2/SM58 dynamic cardioid wireless handheld microphone, and one (1) SHURE Model No WL183 lapel microphone with SLX1 transmitter. Each complete with an ON/OFF switch and batteries

IV. MICROPHONE STANDS

A. This Contractor shall furnish to the Owner's representative, two (2) ATLAS SOUND Model No. MS-20 microphone floor stands.

B. This Contractor shall furnish to the Owner's representative, two (2) ATLAS SOUND Model No. DS-2 microphone desk stands.

V. MICROPHONE OUTLETS

A. This Contractor shall furnish and install where shown on the Drawings, flush or surface wall and/or ceiling mounted microphone outlets (Type "A") consisting of CANNON "XLR" complete with 3 pin XLR (female) series audio jack of the type required so as to be compatible with the type of microphone cable connector furnished, and a stainless-steel cover plate. A microphone outlet, which meets this Specification shall be as manufactured by CONQUEST AUDIO or approved equal.

B. This Contractor shall furnish and install where shown on the Drawings, flush or surface wall mounted Microphone outlets (Type "B") consisting of one (1) CANNON "XLR", complete with 3 pin XLR (female), series audio jack of the type required so as to be compatible with the type of microphone cable connector furnished, one (1) 3.5mm stereo audio jack (MP3), and a stainless-steel cover plate. A Microphone/MP3 outlet, which meets this Specification shall be as manufactured by CONQUEST AUDIO or approved equal.

C. This Contractor shall furnish and install where shown on the Drawings, flush floor mounted microphone outlets (Type "B") consisting of a CANNON "XLR" complete with 3 pin XLR (female) series audio jack, of the type required so as to be compatible with the type of microphone cable connector furnished, and one (1) 3.5mm stereo audio jack (MP3) mounted in a MAXICOM "Telematic" floor box with one (1) NEMA 5-20R duplex receptacle as hereinbefore specified, non-skid top, and tamperproof screws.

VI. GYMNASIUM SOUND SYSTEM CABLE

A. This Contractor shall furnish and install speaker cable consisting of one (1) twisted pair, No. 12 AWG unshielded with a temperature range for dry locations of minus ten (10) degrees C to seventy-five (75) degrees C. A cable that meets this Specification is

WEST PENN Cat. No. 25227B or equal as manufactured by BELDEN, CONSULIDATED WIRE, GENERAL CABLE, PAIGE, or TAPPAN.

B. This Contractor shall furnish and install field wiring for Microphone outlets as shown on the Drawings. Wiring shall be two (2) conductor, No. 20 AWG stranded and shielded cable. A cable that meets this Specification is WEST PENN Cat. No. 25292B or equal as manufactured by BELDEN, CONSULIDATED WIRE, GENERAL CABLE, PAIGE, or TAPPAN.

C. This Contractor shall furnish and install field wiring for MP3 outlets as shown on the Drawings. Wiring shall be two (2) conductor, No. 20 AWG stranded and shielded cable. A cable that meets this Specification is WEST PENN Cat. No. 25292B or equal as manufactured by BELDEN, CONSULIDATED WIRE, GENERAL CABLE, PAIGE, or TAPPAN.

VII. AM/FM ANTENNA

A. This Contractor shall furnish and install a PIXEL TECHNOLOGIES Model No. AFHD-4 AM/FM and HD antenna complete with: L mounting bracket; weather boot; surge protector; 20dB attenuator; 10dB attenuator; AM/FM separator; U- bolts with washers and nuts; pole mount saddle brackets; F-female to twin-lead adaptor and push-on-F-female to DIN adaptor. This Contractor shall furnish and install a weatherhead, rigid steel conduit mast, and two (2) RG-6 plenum rated cables from the antennas to the tuner located in the sound and intercommunication system equipment rack. This Contractor shall ground the antenna in accordance with the following specification.

Part 3 - Execution

I. INSTALLATION

A. All wiring for the Gymnasium sound reinforcement system shall be installed by this Contractor in minimum 1/2-inch conduit as hereinbefore specified. All junction box covers shall be stenciled by this Contractor for distinct identification. All conduit, device mounting boxes, junction boxes, and enclosures shall be securely fastened with appropriate fittings to insure a positive ground throughout the entire system.

B. All low voltage wiring connections shall be made by this Contractor as directed by the manufacturer. Splices for circuits shall be made only in junction boxes and shall be crimp connected.

C. All low voltage wiring shall be checked and tested by this Contractor to insure the system is free from grounds, opens, and shorts.

D. All work shall be under the direct supervision of an accredited factory sound engineer. It shall be the responsibility of the sound engineer and this Contractor to check and inspect this installation to the Architect/Engineer's approval.

II. RACK MOUNTED EQUIPMENT

A. The Gymnasium sound system's rack mounted equipment shall be furnished and installed by this Contractor with the proper adapters, rack mounting kits, brackets, and closure panels for unused space. All interconnecting wiring shall be labeled, bundled, secured, and terminated by this Contractor in a neat and professional manner.

B. All rack mounted equipment AC power cords shall be plugged into the rack mounted power strip.

III. SPEAKERS

A. The speaker systems shall be securely mounted to the building structure by this Contractor at the locations shown and as detailed on the Drawings. All bracing shall be painted to match the surrounding structure. This Contractor shall coordinate the exact hanging angles with the system supplier and the Owner prior to the installation.

IV. MICROPHONES

A. This Contractor shall unpack and assemble microphones complete with all cables, connectors, and stands and connect ready for operation.

V. MICROPHONE OUTLETS

A. This Contractor shall assemble microphone outlets and install, connect, and label as shown on the Drawings.

VI. CABLES

A. All wiring and cable for the Gymnasium sound reinforcement system shall be pulled continuously through conduits without splices or abrasions and shall be terminated at their appropriate devices as shown on the Drawings, specified herein, and as directed by the system supplier. All cables shall be labeled. Input and output cabling shall not be installed in the same raceway.

VII. ANTENNA INSTALLATION

A. The antenna shall be bracket mounted by this Contractor above the roof at a location approved by the Owner. The antenna cables shall be run by this Contractor to the equipment rack and connected ready for operation.

B. The antenna shall be grounded by this Contractor to the secondary building ground system with one (1) No. 10 AWG in ½ inch conduit.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include furnishing and installing a locally controlled complete and satisfactorily operating sound system in each of the Band, Choral, Orchestra and General Music Rooms for the pickup, amplification, reproduction, and distribution of voice and/or music to associated loudspeakers within each room.

B. Existing Band, Choral, Orchestra and General Music Rooms sound reinforcement systems equipment may be reused as noted on the Drawings. This Contractor shall exercise extreme care not to damage the equipment while following the instructions on the Drawings. The equipment to be reused shall be protected from construction before, during, and after work has been completed.

III. QUALITY ASSURANCE

A. All equipment described shall be the product of a manufacturer of established reputation and experience produced similar apparatus for a period of at least ten (10) years and shall be able to refer to similar installations now rendering satisfactory service.

B. The Band, Choral, Orchestra and General Music Rooms sound reinforcement systems shall be furnished by a factory authorized distributor certified to design, program, and service the system. The distributor must show evidence of successfully furnishing systems specified for at least five (5) years.

C. All equipment for the Band, Choral, Orchestra and General Music Rooms sound reinforcement systems shall be listed Underwriters Laboratories, Inc. (UL) bear the UL label and shall be installed in accordance with all requirements of the National Electrical Code (NEC), state and local codes, and these Specifications.

D. Each of the Band, Choral, Orchestra and General Music Rooms sound reinforcement systems installation shall be performed under the direct supervision of a factory trained service specialist.

E. Shop drawing submittals are required per SECTION 230500 and shall include the following for review. Submittals not containing all of the information listed below will be rejected.

1. A complete list of equipment for each Band, Choral, Orchestra and General Music Rooms sound reinforcement system shall be furnished indicating the specific quantities to be furnished by this Contractor. The catalog or model number for each module of each system shall be listed next to the quantities. This information shall be furnished in the front of the submittal.

2. A specific description of each of the Band, Choral, Orchestra and General Music Rooms sound reinforcement systems shall be furnished describing each module and how it shall function within each system.

3. A specific drawing shall be furnished of each Band, Choral, Orchestra and General Music Rooms sound reinforcement system equipment rack. Each module shall be shown in its proper location with its terminal designation shown.

4. A data sheet shall be furnished for each module and device. The information shall be highlighted that applies to the particular module or device to be furnished.

5. A detailed diagram showing how to connect each device shall be furnished indicating exact final connection information.

6. A detailed floor plan for each Band, Choral, Orchestra and General Music Room shall be furnished. The plans shall show the locations of all equipment, loudspeakers, and devices and their required interconnections. The interconnections shown shall indicate the number, size, and type of wires as described in this Specification. Loudspeakers shall be zoned as shown on the Drawings. The layout of all Band, Choral, Orchestra and General Music Rooms sound reinforcement system equipment, devices, and conduit routings shall closely follow that shown on the Drawings.

IV. DOCUMENTATION

A. This Contractor shall furnish to the Contractor, one (1) set of "As Built" drawings for each Band, Choral, Orchestra and General Music Room sound reinforcement system depicting the complete field wiring system and component interconnections in each system equipment rack.

B. This Contractor shall furnish to the Contractor, four (4) sets of factory operation and maintenance manuals. These manuals shall include factory service manuals with complete parts lists, wiring and component schematics including circuit diagrams, and all other information necessary for the proper operation, service, and maintenance of each Band, Choral, Orchestra and General Music Room sound reinforcement system.

V. TRAINING

A. This Contractor shall furnish eight (8) hours (total for all rooms) of technical service training to the Owner's technical staff using the factory service manuals previously specified.

B. This Contractor shall furnish eight (8) hours (total for all rooms) of operating and programming training to the Owner's operating staff which shall be delivered in two (2) separate four (4) hours sessions to be scheduled at the Owner's convenience over the warranty period.

C. All training specified herein shall be performed by a factory certified technician.

VI. DESCRIPTION OF OPERATION

A. This Contractor shall furnish and install Band, Choral, Orchestra and General Music Rooms sound reinforcement systems with all conduit, cable, outlets, devices, and equipment as shown on the Drawings and as herein specified to furnish complete systems.

B. Each Band, Choral, Orchestra and General Music Rooms sound reinforcement system shall provide for reception of AM or FM radio broadcasts, the amplification of music and voice, and the reproduction of recorded music or other program materials, and their distribution to all associated speakers within each Band, Choral, and Orchestra Room.

C. Each Band, Choral, Orchestra and General Music Room sound reinforcement system shall accept both the input and output of an external tape recorder.

D. Each Band, Choral, Orchestra and General Music Room sound reinforcement system shall accept a priority override signal to mute the system when the main building Sound and Intercommunications System activates the priority override function.

VII. SYSTEM TEST AND ACCEPTANCE

A. Prior to the final site visitation this Contractor shall conduct an operating test of each complete Band, Choral, Orchestra and General Music Rooms sound reinforcement system. Each system shall test free from grounds, shorts, and other faults. All connections shall be thoroughly checked for mechanical and electrical connections. All equipment shall be demonstrated to operate in accordance with the requirements set forth in these Specifications and as shown on the Drawings.

B. This Contractor shall perform all tests in the presence of the Architect/Engineer. This Contractor shall furnish all personnel and test instruments for use in the test.

C. When the work on each Band, Choral, Orchestra and General Music Room sound reinforcement system has been completed and is ready for final review, this Contractor shall demonstrate that the requirements of the Contract as it applies to this work have been carried out and that the system has been adjusted and operated in accordance therewith.

VIII. WARRANTY

A. This Contractor shall deliver the work described herein in a first-class operating condition in every respect. This Contractor shall also warrant that the material, equipment, and workmanship furnished shall be entirely free from defects. Any materials, equipment, or workmanship in which defects may develop before or during the warranty period shall be repaired or replaced at the Contractors own expense. Refer to SECTION 01740 for the start of the warranty period. The contractor shall further warrant that all material, equipment, and workmanship used in the installation, but not specifically mentioned in the Drawings and Specifications, is the best of their respective kinds and that the construction and installation was performed in accordance with the best accepted standard practices in all details.

Part 2 - Products

I. EQUIPMENT RACKS

A. This Contractor shall furnish and install in each Band, Choral, Orchestra and General Music Room where shown on the Drawings, a wall mounted equipment rack for the room's sound reinforcement system as specified herein. Each rack shall be ATLAS SOUND Cat. No. WMA24-23 sectional, wall mounting type with a textured black finish providing a minimum of sixty-one (61) inches of vertical rack mounting space. Each rack shall be complete with a continuous piano hinged front door with a cylinder lock and handle. The following equipment shall be furnished and installed by this Contractor in each rack:

1. One (1) TOA Model No. D-901 twelve (12) input, eight (8) output, digital mixer. Mixer shall come complete with:

   a) One (1) D936R four (4) stereo input module (tuner, CD, MP3 outlets).

   b) One (1) D971E four (4) channel line output module (personal listening system, amplifier).

   c) Four (4) D921E 2-channel input modules (microphone outlets).

2. One (1) CROWN Model No. CTs 600 dual channel amplifier with three hundred (300) watts per channel at eight (8) ohms. Amplifier shall be suitable

3. One (1) TASCAM Model No. SS-CDR200 rack mounted MP3/CD recorder workstation complete with minimum 8GB compact flash card.

4. One (1) PYLE Model No. PT504 rack mounted stereo AM/FM tuner.

5. One (1) ATLAS SOUND Model No. ACS-1 AC power strip suitable for rack mounting.

6. One (1) SHURE "SLX" series UHF Wireless Microphone System complete with Model No. SLX4 wireless receiver complete with rack mounting hardware and detachable antennas

II. WALL MOUNTED STEREO SPEAKERS

A. This Contractor shall furnish and install where shown on the Drawings, two (2) JBL Model No "C29AV-1" enclosed wall mounted stereo speakers. The stereo speakers shall be 300 watts, 8 ohms. Each stereo speaker shall be complete with wall mounting bracket.

III. MICROPHONES

A. This Contractor shall furnish to the Owner's representative, four (4) SHURE Model No. SM58S dynamic cardioid microphones for each Band, Choral, Orchestra and General

Music Room sound reinforcement system (total of **CONSULTANT SHALL EDIT**). Each microphone shall be furnished by this Contractor complete with a twenty-five (25) foot connector cord with CANNON XLR connectors.

B. This Contractor shall furnish to the Owner's representative, one (1) SHURE Model No. SLX2/SM58 dynamic cardioid wireless handheld microphone and one (1) SHURE Model No WL183 lapel microphone with SLX1 transmitter for each Band, Choral, Orchestra and General Music Room sound reinforcement system. Each complete with an ON/OFF switch and batteries

C. This Contractor shall furnish and install in the Choral Room three (3) SHURE Model No. MX202B/C hanging microphones at locations shown on the Drawings.

IV. MICROPHONE STANDS

A. This Contractor shall furnish to the Owner's representative, four (4) ATLAS SOUNDOLIER Model No. MS-20 microphone floor stands for each Band, Choral, Orchestra and General Music Room sound reinforcement system.

B. This Contractor shall furnish to the Owner's representative, four (4) ATLAS SOUNDOLIER Model No. PB15CH microphone booms for each Band, Choral, Orchestra and General Music Room sound reinforcement systems.

V. MICROPHONE OUTLETS

A. This Contractor shall furnish and install where shown on the Drawings, flush or surface wall and/or ceiling mounted microphone outlets (Type "A") consisting of CANNON "XLR" complete with 3 pin XLR (female) series audio jack of the type required so as to be compatible with the type of microphone cable connector furnished, and a stainless-steel cover plate. A microphone outlet, which meets this Specification shall be as manufactured by CONQUEST AUDIO or approved equal.

B. This Contractor shall furnish and install where shown on the Drawings, flush or surface wall mounted Microphone outlets (Type "B") consisting of one (1) CANNON "XLR", complete with 3 pin XLR (female), series audio jack of the type required so as to be compatible with the type of microphone cable connector furnished, one (1) 3.5mmstereo audio jack (MP3), and a stainless-steel cover plate. A Microphone/MP3 outlet, which meets this Specification shall be as manufactured by CONQUEST AUDIO or approved equal.

VI. AM/FM ANTENNA

A. This Contractor shall furnish and install a PIXEL TECHNOLOGIES Model No. AFHD-4 AM/FM and HD antenna complete with: L mounting bracket; weather boot; surge protector; 20dB attenuator; 10dB attenuator; AM/FM separator; U- bolts with washers and nuts; pole mount saddle brackets; F-female to twin-lead adaptor and push-on-F-female to DIN adaptor. This Contractor shall furnish and install a weatherhead, rigid steel conduit mast, and two (2) RG-6 plenum rated cables from the antennas to the tuner located in the sound and intercommunication system equipment rack. This Contractor shall ground the antenna in accordance with the following

specification.

VII. BAND, CHORAL, ORCHESTRA AND GENERAL MUSIC ROOMS SOUND SYSTEM CABLE

A. This Contractor shall furnish and install one (1) two (2) conductor, No. 12 AWG stranded plenum rated cable with a temperature range for dry locations of minus ten (10) degrees C to sixty (60) degrees C for each stereo speaker. A cable that meets this Specification is WEST PENN Cat. No. 25227B or equal as manufactured by BELDEN, CONSULIDATED WIRE, GENERAL CABLE, PAIGE, or TAPPAN.

B. This Contractor shall furnish and install one (1) stranded, No. 20 AWG, shielded, single twisted pair plenum rated cable with a temperature range for dry locations of minus ten (10) degrees C to sixty (60) degrees C for each microphone outlet. A cable that meets this Specification is WEST PENN Cat. No. 25292B or equal as manufactured by BELDEN, CONSULIDATED WIRE, GENERAL CABLE, PAIGE, or TAPPAN.

VIII. CEILING MOUNTED PROJECTOR LOCATIONS

A. This contractor shall furnish and install one (1) two (2) conductor No. 12 AWG stranded, plenum rated cable from the audio out port of the ceiling mounted projector to an audio in port for each Band, Choral, Orchestra and General Music Room sound reinforcement systems shown on the drawings.

Part 3 - Execution

I. INSTALLATION

A. All vertical, low voltage field wiring shall be installed by this Contractor in 1/2-inch conduit and/or surface metal raceway as shown on the Drawings. Conduit fill shall not exceed the conduit space capacity.

B. All horizontal, low voltage field wiring to be installed in areas without a ceiling or in areas without an accessible ceiling shall be installed by this Contractor in 1/2-inch conduit.

C. All horizontal low voltage field wiring to be installed in areas with accessible ceilings shall be installed by this Contractor bundled together and run exposed above the ceilings. Bundles shall be supported by "J" hooks mounted not more than four (4) feet on center. “J” hooks shall be dedicated to the wiring specified in this specification section.

D. All horizontal, low voltage field wiring shall be run at right angles to the building structure.

E. All horizontal low voltage field wiring shall be installed below the roof/floor structural supports (joist, beams, girders, etc.). Wiring installed between the structural supports mentioned above and the roof or floor deck will not be acceptable.

F. All horizontal low voltage field wiring penetrations through new and/or existing walls shall be sleeved. Minimum sleeve size shall be 3/4 inch. All sleeves shall be bushed both sides.

G. All low voltage field wiring for the Band, Choral, Orchestra and General Music Room sound reinforcement systems shall be furnished and installed by this Contractor. All junction box covers shall be stenciled for distinct identification.

H. This Contractor as directed by the equipment manufacturer shall make all wiring connections. Splices for circuits shall be made only in junction boxes and shall be crimp connected.

I. All Band, Choral, Orchestra and General Music Room sound reinforcement systems wiring shall be checked and tested by this Contractor to insure the system is free from grounds, opens, and shorts.

J. All work shall be under the supervision of a factory accredited sound engineer. It shall be the responsibility of the sound engineer and this contractor to check and inspect this installation to the Owner's and Architect/Engineer's approval.

II. RACK MOUNTED EQUIPMENT

A. Each Band, Choral, Orchestra and General Music Room sound reinforcement system's rack mounted equipment shall be installed by this Contractor with the proper adapters, rack mounting kits, brackets, and closure panels for unused spaces. All interconnecting wiring shall be labeled, bundled, secured, and terminated by this Contractor in a neat and professional manner.

B. All rack mounted equipment AC power cords shall be plugged into the mounted power strip by this Contractor.

III. SPEAKER

A. Wall mounted stereo speakers shall be securely fastened to the building structure by this Contractor with threaded rod or bolts as appropriate for the application.

B. This Contractor shall furnish and install a NEMA 5-20R duplex receptacle (as hereinbefore specified) at each stereo speaker location whether shown on the Drawings or not. Duplex receptacles shall be on their own circuit.

IV. MICROPHONES

A. This Contractor shall unpack microphone and assemble with cables and stands and connect ready for operation. Microphones shown for permanent installation shall be mounted by this Contractor in accordance with the Drawings in a manner appropriate for the location.

V. MICROPHONES OUTLETS

A. This Contractor shall assemble microphone outlets and install, connect, and label as shown on Drawings.

VI. ANTENNA INSTALLATION

A. The antenna shall be bracket mounted by this Contractor above the roof at a location approved by the Owner. The antenna cables shall be run by this Contractor to the equipment rack and connected ready for operation.

B. The antenna shall be grounded by this Contractor to the secondary building ground system with one (1) No. 10 AWG in 1/2-inch conduit.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include furnishing and installing a separate locally controlled complete and satisfactorily operating Athletic Field sound reinforcement system for the pickup, amplification, reproduction, and distribution of voice and/or music to associated loudspeakers for each of the following: Baseball Field; Football Stadium; Softball Field; and Track and Field area.

III. QUALITY ASSURANCE

A. All equipment described shall be the product of a manufacturer of established reputation and experience producing similar apparatus for a period of at least ten (10) years and shall be able to refer to similar installations now rendering satisfactory service.

B. The Athletic Fields sound reinforcement systems shall be furnished by a factory authorized distributor certified to design, program, and service the system. The distributor must show evidence of successfully furnishing systems specified for at least five (5) years.

C. All equipment for the Athletic Fields sound reinforcement systems shall be listed by Underwriters Laboratories, Inc. (UL), bear the UL label, and shall be installed in accordance with all requirements of the National Electrical Code (NEC), state and local codes, and these Specifications.

D. Each Athletic Field sound reinforcement system installation shall be performed under the direct supervision of a factory trained service specialist.

E. Shop drawing submittals are required per SECTION 260500 and shall include the following for review:

1. A complete list of equipment for each Athletic Field area shall be furnished indicating the specific quantities for each area to be furnished by the manufacturer. The catalog or model number for each module of each system shall be listed next to the quantities. This information shall be furnished in the front of the submittal.

2. A specific description of each Athletic Field sound reinforcement system shall be furnished describing each module and how it shall function in the associated system.

3. A detailed plan of each Athletic Field area shall be furnished showing the locations of all equipment, loudspeakers, and devices and their required

interconnections. The interconnections shown shall indicate the number, size, and type of wires as described in this Specification. The layout of all equipment, devices, and conduit routings shall closely follow that shown on the Drawings.

4. A specific drawing of each Athletic Field sound reinforcement system rack shall be made by the equipment supplier. Each module shall be shown in its proper location with its terminal designation shown.

5. A data sheet shall be furnished for each module and device. The information shall be highlighted that applies to the particular module or device to be furnished.

6. A detailed diagram showing how to connect each device shall be furnished indicating exact final connection information.

7. A detailed drawing showing how to mount the Football, Baseball, Softball, and Track and Field Speakers, shall be furnished, including necessary hardware and mounting devices.

IV. DOCUMENTATION

A. This Contractor shall furnish to the Contractor, one (1) set of "As Built" drawings for each Athletic Field area depicting the complete wiring system and component interconnections in each system equipment rack.

B. This Contractor shall furnish to the Contractor, four (4) sets of factory operation and maintenance manuals for each Athletic Field sound reinforcement system. These manuals shall be including factory service manuals with complete parts lists, wiring and component schematics including circuit diagrams, and all other information necessary for the proper operation and service maintenance of the system.

V. TRAINING

A. This Contractor shall furnish eight (8) hours (total for all Athletic Fields) of technical service training to the Owner's technical staff using the factory service manuals previously specified.

B. This Contractor shall furnish eight (8) hours (total for all Athletic Fields) of operating and programming training to the Owner's operating staff which shall be delivered in two (2) separate four (4) hour sessions to be scheduled at the Owner's convenience over the warranty period.

C. All training specified herein shall be performed by a factory certified technician.

VI. DESCRIPTION OF OPERATION

A. This Contractor shall furnish and install Athletic Fields sound reinforcement systems with all conduit, wiring, outlets, and equipment as shown on the Drawings and as herein specified to furnish complete systems.

B. Each Athletic Field sound reinforcement system shall provide for the amplification of music and voice, and the reproduction of recorded music or other program materials, and their distribution to all associated speakers.

C. Each Athletic Field sound reinforcement system shall provide a personal listening system for use by hearing impaired listeners.

VII. SYSTEM TEST AND ACCEPTANCE

A. Prior to the final site visitation this Contractor shall conduct an operating test of each complete Athletic Field sound reinforcement system. Each system shall test free from grounds, shorts, and other faults. All connections shall be thoroughly checked for mechanical and electrical connections. All equipment shall be demonstrated to operate in accordance with the requirements set forth in these Specifications and as shown on the Drawings.

B. This Contractor shall perform all tests in the presence of the Architect/Engineer. This Contractor shall furnish all personnel and test instruments for use in the test.

C. When the work on each Athletic Field sound reinforcement system has been completed and is ready for final review, this Contractor shall demonstrate that the requirements of the Contract as it applies to this work have been carried out and that each system has been adjusted and operated in accordance therewith.

VIII. WARRANTY

A. This Contractor shall deliver the work described herein in a first-class operating condition in every respect. This Contractor shall also warrant that the material, equipment, and workmanship furnished shall be entirely free from defects. Any materials, equipment, or workmanship in which defects may develop before or during the warranty period shall be repaired or replaced at the Contractors own expense. Refer to SECTION 01740 for the start of the warranty period. The contractor shall further warrant that all material, equipment, and workmanship used in the installation, but not specifically mentioned in the Drawings and Specifications, is the best of their respective kinds and that the construction and installation was performed in accordance with the best accepted standard practices in all details.

Part 2 - Products

I. BASEBALL FIELD SOUND REINFORCEMENT SYSTEM

A. EQUIPMENT RACK

1. This Contractor shall furnish and install a sectional wall mounted Baseball Field sound reinforcement system equipment rack as shown on the Drawings and as specified herein. The rack shall be ATLAS SOUND Cat. No. WMA24-23 sectional, wall mounting type with a textured black finish providing a minimum of forty-two (42) inches of vertical rack mounting space. The rack shall be complete with a continuous piano hinged front door with a cylinder lock and

handle. The baseball field sound system equipment rack shall have a sign mounted to the front stating, “Personal Listening Devices Stored Here”. The sign shall be 1/16-inch-thick laminated plastic with 3/16-inch-high white letters on a black background. The following equipment shall be furnished and installed by this Contractor in the rack:

a) One (1) dual channel power amplifier suitable for rack mounting with a minimum rating of 300 watts’ continuous sine wave per channel into an eight (8) ohm output at twenty (20) Hz to twenty (20) kHz with a maximum 0.1 percent (0.1%) distortion. A power amplifier that will meet this specification is CROWN Model No. CTs 600.

b) One (1) PASO Model No. DMS260P ten (10) channel, digital mixer/preamplifier with 27/3501 Rack Mount Kit.

c) One (1) PASO Model No. PM01ML Mic/Line input module

d) One (1) PYLE Model No. PT504 rack mounted stereo AM/FM tuner.

e) One (1) TASCAM Model No. CD-200i, rack mounted CD player with MP3 dock.

f) One (1) WILLIAMS SOUND Model No. PPA T35 personal listening system base station transmitter complete with WILLIAMS SOUND Model No. RPK 005 rack mounting kit and ANT 005 coaxial antennae.

g) The Contractor shall furnish and install in the charging stations, twelve (12) WILLIAMS SOUND Model No. No. PPA R37, seventeen (17) channel personal listening system receivers each complete with WILLIAMS SOUND Model No. EAR 013 single earbud, rechargeable batteries, and belt clip.

h) This contractor shall furnish to the owner’s representative, four (4) WILLIAMS SOUND Model NKL 001 neckloops.

i) The Contractor shall furnish and install one (1) WILLIAMS SOUND Model No. CHG 3512 twelve (12) unit charging station for the personal listening system receivers complete with one (1) ATLAS SOUND Model No. VTD1-16 rack sliding shelf

j) One (1) ATLAS SOUND Model No. ACRL-191 AC power supply module suitable for rack mounting.

k) One (1) ATLAS SOUND Model No. ACS-1 AC power strip.

l) One (1) SHURE “SLX” series UHF Wireless Microphone System complete with Model No. SLX4 wireless receiver complete with rack mounting hardware and detachable antennas.

B. Speaker Systems:

1. This Contractor shall furnish and install two (2), horn type loudspeakers of the compound diffraction design rated 15W to 120 watts, 70.0 volts with a frequency response of 90 Hz - 16 kHz and shall include a driver. A horn type loudspeaker that will meet this Specification is COMMUNITY Model No. R.5-66T or equal as manufactured by JBL.

C. Microphones:

1. This Contractor shall furnish to the Owner's representative, one (1) SHURE Model No. SM58S dynamic cardioid microphone complete with an ON/OFF switch. The microphone shall be furnished by this Contractor complete with a twenty-five (25) foot connector cord with CANNON XLR connectors.

2. This Contractor shall furnish to the Owner's representative, one (1) SHURE Model No. SLX2/SM58 dynamic cardioid wireless handheld microphone, and one (1) SHURE Model No WL183 lapel microphone with SLX1 transmitter. Each complete with an ON/OFF switch and batteries

D. Microphone Stand:

1. This Contractor shall furnish to the Owner's representative, one (1) ATLAS SOUND Model No. DS-2 microphone desk stand.

E. Microphone Outlets:

1. This Contractor shall furnish and install where shown on the Drawings, flush or surface wall and/or ceiling mounted microphone outlets (Type "A") consisting of CANNON "XLR" complete with 3 pin XLR (female) series audio jack of the type required so as to be compatible with the type of microphone cable connector furnished, and a stainless-steel cover plate. A microphone outlet, which meets this Specification shall be as manufactured by CONQUEST AUDIO or approved equal.

2. This Contractor shall furnish and install where shown on the Drawings, flush or surface wall mounted Microphone outlets (Type "B") consisting of one (1) CANNON "XLR", complete with 3 pin XLR (female), series audio jack of the type required so as to be compatible with the type of microphone cable connector furnished, one (1) 3.5mmstereo audio jack (MP3), and a stainless-steel cover plate. A Microphone/MP3 outlet, which meets this Specification shall be as manufactured by CONQUEST AUDIO or approved equal.

F. Baseball Field System Cable:

1. This Contractor shall furnish and install speaker cable consisting of one (1) twisted pair, No. 12 AWG unshielded with a temperature range for dry locations of minus twenty-five (25) degrees C to one hundred five (105) degrees C and seventy-five (75) degrees C for wet locations. A cable that meets this Specification is WEST PENN Cat. No. AQ227 or equal as manufactured by

BELDEN, CONSULIDATED WIRE, GENERAL CABLE, PAIGE, or TAPPAN.

2. This Contractor shall furnish and install field wiring for microphone outlets as shown on the Drawings. Wiring shall be two (2) conductor, No. 20 AWG stranded and shielded cable. A cable that meets this Specification is WEST PENN Cat. No. 25292B or equal as manufactured by BELDEN, CONSULIDATED WIRE, GENERAL CABLE, PAIGE, or TAPPAN.

3. This Contractor shall furnish and install field wiring for MP3 outlets as shown on the Drawings. Wiring shall be two (2) conductor, No. 20 AWG stranded and shielded cable. A cable that meets this Specification is WEST PENN Cat. No. 25292B or equal as manufactured by BELDEN, CONSULIDATED WIRE, GENERAL CABLE, PAIGE, or TAPPAN.

II. FOOTBALL FIELD SOUND REINFORCEMENT SYSTEM

A. Equipment Rack:

1. This Contractor shall furnish and install a floor mounted equipment rack for the football field sound reinforcement system as shown on the Drawings and as specified herein. The rack(s) shall be ATLAS SOUND Cat. No. WA200-77B providing a minimum of seventy-seven (77) inches of standard nineteen (19) inch rack mounting space. The rack(s) shall be complete with a hinged front door with cylinder lock and handle, and a flush spring-hinged rear door with cylinder lock (front and rear locks shall be keyed differently) and handle. The football field sound system equipment rack shall have a sign mounted to the front stating, “Personal Listening Devices Stored Here”. The sign shall be 1/16-inch-thick laminated plastic with 3/16-inch-high white letters on a black background. The following equipment shall be furnished and installed by this Contractor in the rack:

a) One (1) dual channel power amplifier (Home) suitable for rack mounting with a minimum rating of 2400 watts’ continuous sine wave per channel into a four (4) ohm output at twenty (20) Hz to twenty (20) kHz with a maximum 0.1 percent (0.1%) distortion. A power amplifier, which will meet this specification, is CROWN Model No. CTs-2000.

b) One (1) dual channel power amplifier (Visitor) suitable for rack mounting with a minimum rating of 1200 watts’ continuous sine wave per channel into a four (4) ohm output at twenty (20) Hz to twenty (20) kHz with a maximum 0.1 percent (0.1%) distortion. A power amplifier, which will meet this specification, is CROWN Model No. CTs-1200.

c) One (1) PASO Model No. DMS260P ten (10) channel, digital mixer/preamplifier with 27/3501 Rack Mount Kit.

d) One (1) PASO Model No. PM01ML Mic/Line input module.

e) One (1) PYLE Model No. PT504 rack mounted stereo AM/FM tuner.

f) One (1) TASCAM Model No. CD-200i, rack mounted CD player with MP3 dock.

g) One (1) WILLIAMS SOUND Model No. PPA T35 personal listening system base station transmitter complete with WILLIAMS SOUND Model No. RPK 005 rack mounting kit and ANT 005 coaxial antenna.

h) The Contractor shall furnish and install in the charging stations, thirty-six (36) WILLIAMS SOUND Model No. No. PPA R37, seventeen (17) channel personal listening system receivers each complete with WILLIAMS SOUND Model No. EAR 013 single earbud, rechargeable batteries, and belt clip.

i) This contractor shall furnish to the owner's representative, nine (9) WILLIAMS SOUND Model NKL 001 neckloops.

j) The Contractor shall furnish and install three (3) WILLIAMS SOUND Model No. CHG 3512 twelve (12) unit charging stations for the personal listening system receivers complete with three (3) ATLAS SOUND Model No. VTD1-16 rack sliding shelf

k) One (1) ATLAS SOUND Model No. ACRL-191 AC power supply module suitable for rack mounting.

l) One (1) ATLAS SOUND Model No. ACS-1 AC power strip.

m) One (1) SHURE "SLX" series UHF Wireless Microphone System complete with Model No. SLX4 wireless receiver complete with rack mounting hardware and detachable antennas

B. Speaker Systems:

1. This Contractor shall furnish and install two (2), 3-way loudspeaker system (Home) with a frequency response of 70 Hz - 4 kHz and shall include a driver. A speaker, which will meet this Specification, is COMMUNITY Model No. R2-474 complete with COMMUNITY Model No. R2YOKE mounting yoke kit or equal as manufactured by JBL.

2. This Contractor shall furnish and install one (1), 3-way loudspeaker system (Visitor) with a frequency response of 70 Hz - 4 kHz and shall include a driver. A speaker, which will meet this Specification, is COMMUNITY Model No. R2-52 complete with COMMUNITY Model No. R2YOKE mounting yoke kit or equal as manufactured by JBL.

C. Microphones:

1. This Contractor shall furnish to the Owner's representative, four (4) SHURE Model No. SM58S dynamic cardioid microphones. Each complete with an ON/OFF switch. Each microphone shall be furnished by this Contractor complete with a twenty-five (25) foot connector cord with CANNON XLR

connectors

2. This Contractor shall furnish to the Owner's representative, one (1) SHURE Model No. SLX2/SM58 dynamic cardioid wireless handheld microphone, and one (1) SHURE Model No WL183 lapel microphone with SLX1 transmitter. Each complete with an ON/OFF switch and batteries

D. Microphone Stands:

1. This Contractor shall furnish to the Owner's representative, two (2) ATLAS SOUND Model No. DS-2 microphone desk stands.

2. This Contractor shall furnish to the Owner's representative, two (2) ATLAS SOUND Model No. MS-20 microphone floor stands.

E. Microphone Outlets:

1. This Contractor shall furnish and install where shown on the Drawings, flush or surface wall and/or ceiling mounted microphone outlets (Type "A") consisting of CANNON "XLR" complete with 3 pin XLR (female) series audio jack of the type required so as to be compatible with the type of microphone cable connector furnished, and a stainless-steel cover plate. A microphone outlet, which meets this Specification shall be as manufactured by CONQUEST AUDIO or approved equal.

2. This Contractor shall furnish and install where shown on the Drawings, flush or surface wall mounted Microphone outlets (Type "B") consisting of one (1) CANNON "XLR", complete with 3 pin XLR (female), series audio jack of the type required so as to be compatible with the type of microphone cable connector furnished, one (1) 3.5mmstereo audio jack (MP3), and a stainless-steel cover plate. A Microphone/MP3 outlet, which meets this Specification shall be as manufactured by CONQUEST AUDIO or approved equal.

F. Football Field System Cable:

1. This Contractor shall furnish and install speaker cable consisting of one (1) twisted pair, No. 12 AWG unshielded with a temperature range for dry locations of minus twenty-five (25) degrees C to one hundred five (105) degrees C and seventy-five (75) degrees C for wet locations. A cable that meets this Specification is WEST PENN Cat. No. AQ227 or equal as manufactured by BELDEN, CONSULIDATED WIRE, GENERAL CABLE, PAIGE, or TAPPAN.

2. This Contractor shall furnish and install field wiring for microphone outlets as shown on the Drawings. Wiring shall be two (2) conductor, No. 20 AWG stranded and shielded cable. A cable that meets this Specification is WEST PENN Cat. No. 25292B or equal as manufactured by BELDEN, CONSULIDATED WIRE, GENERAL CABLE, PAIGE, or TAPPAN.

3. This Contractor shall furnish and install field wiring for MP3 outlets as shown on

the Drawings. Wiring shall be two (2) conductor, No. 20 AWG stranded and shielded cable. A cable that meets this Specification is WEST PENN Cat. No. 25292B or equal as manufactured by BELDEN, CONSULIDATED WIRE, GENERAL CABLE, PAIGE, or APPAN.

III. SOFTBALL FIELD SOUND REINFORCEMENT SYSTEM

A. EQUIPMENT RACK

1. This Contractor shall furnish and install a sectional wall mounted Softball Field sound reinforcement system equipment rack as shown on the Drawings and as specified herein. The rack shall be ATLAS SOUND Cat. No. WMA24-23 sectional, wall mounting type with a textured black finish providing a minimum of forty-two (42) inches of vertical rack mounting space. The rack shall be complete with a continuous piano hinged front door with a cylinder lock and handle. The softball field sound system equipment rack shall have a sign mounted to the front stating, “Personal Listening Devices Stored Here”. The sign shall be 1/16-inch-thick laminated plastic with 3/16-inch-high white letters on a black background. The following equipment shall be furnished and installed by this Contractor in the rack:

a) One (1) dual channel power amplifier suitable for rack mounting with a minimum rating of 300 watts continuous sine wave per channel into an eight (8) ohm output at twenty (20) Hz to twenty (20) kHz with a maximum 0.1 percent (0.1%) distortion. A power amplifier that will meet this specification is CROWN Model No. CTs 600.

b) One (1) PASO Model No. DMS260P ten (10) channel, digital mixer/preamplifier with 27/3501 Rack Mount Kit.

c) One (1) PASO Model No. PM01ML Mic/Line input module

d) One (1) PYLE Model No. PT504 rack mounted stereo AM/FM tuner.

e) One (1) TASCAM Model No. CD-200i, rack mounted CD player with MP3 dock.

f) One (1) WILLIAMS SOUND Model No. PPA T35 personal listening system base station transmitter complete with WILLIAMS SOUND Model No. RPK 005 rack mounting kit and ANT 005 coaxial antenna.

g) The Contractor shall furnish and install in the charging stations, twelve (12) WILLIAMS SOUND Model No. No. PPA R37, seventeen (17) channel personal listening system receivers each complete with WILLIAMS SOUND Model No. EAR 013 single earbud, rechargeable batteries, and belt clip.

h) This contractor shall furnish to the owners representative, four (4) WILLIAMS SOUND Model NKL 001 neckloops.

i) The Contractor shall furnish and install (1) WILLIAMS SOUND Model No. CHG 3512 twelve (12) charging station for the personal listening system receivers complete with one (1) ATLAS SOUND Model No. VTD1-16 rack sliding shelf

j) One (1) ATLAS SOUND Model No. ACRL-191 AC power supply module suitable for rack mounting.

k) One (1) ATLAS SOUND Model No. ACS-1 AC power strip.

l) One (1) SHURE “SLX” series UHF Wireless Microphone System complete with Model No. SLX4 wireless receiver complete with rack mounting hardware and detachable antennas.

B. Speaker Systems:

1. This Contractor shall furnish and install two (2), horn type loudspeakers of the compound diffraction design rated 15W to 120 watts, 70.0 volts with a frequency response of 90 Hz - 16 kHz and shall include a driver. A horn type loudspeaker that will meet this Specification is COMMUNITY Model No. R.5-66T or equal as manufactured by JBL.

C. Microphones:

1. This Contractor shall furnish to the Owner’s representative, one (1) SHURE Model No. SM58S dynamic cardioid microphones complete with an ON/OFF switch. The microphone shall be furnished by this Contractor complete with a twenty-five (25) foot connector cord with CANNON XLR connectors

2. This Contractor shall furnish to the Owner’s representative, one (1) SHURE Model No. SLX2/SM58 dynamic cardioid wireless handheld microphone, and one (1) SHURE Model No WL183 lapel microphone with SLX1 transmitter. Each complete with an ON/OFF switch and batteries

D. Microphone Stand:

1. This Contractor shall furnish to the Owner’s representative, one (1) ATLAS SOUND Model No. DS-2 microphone desk stand.

E. Microphone Outlets:

1. This Contractor shall furnish and install where shown on the Drawings, flush or surface wall and/or ceiling mounted microphone outlets (Type “A”) consisting of CANNON "XLR" complete with 3 pin XLR (female) series audio jack of the type required so as to be compatible with the type of microphone cable connector furnished, and a stainless-steel cover plate. A microphone outlet, which meets this Specification shall be as manufactured by CONQUEST AUDIO or approved equal.

2. This Contractor shall furnish and install where shown on the Drawings, flush or

surface wall mounted Microphone outlets (Type “B”) consisting of one (1) CANNON "XLR", complete with 3 pin XLR (female), series audio jack of the type required so as to be compatible with the type of microphone cable connector furnished, one (1) 3.5mmstereo audio jack (MP3), and a stainless-steel cover plate. A Microphone/MP3 outlet, which meets this Specification shall be as manufactured by CONQUEST AUDIO or approved equal.

F. Softball Field System Cable:

1. This Contractor shall furnish and install speaker cable consisting of one (1) twisted pair, No. 12 AWG unshielded with a temperature range for dry locations of minus twenty-five (25) degrees C to one hundred five (105) degrees C and seventy-five (75) degrees C for wet locations. A cable that meets this Specification is WEST PENN Cat. No. AQ227 or equal as manufactured by BELDEN, CONSULIDATED WIRE, GENERAL CABLE, PAIGE, or TAPPAN.

2. This Contractor shall furnish and install field wiring for microphone outlets as shown on the Drawings. Wiring shall be two (2) conductor, No. 20 AWG stranded and shielded cable. A cable that meets this Specification is WEST PENN Cat. No. 25292B or equal as manufactured by BELDEN, CONSULIDATED WIRE, GENERAL CABLE, PAIGE, or TAPPAN.

3. This Contractor shall furnish and install field wiring for MP3 outlets as shown on the Drawings. Wiring shall be two (2) conductor, No. 20 AWG stranded and shielded cable. A cable that meets this Specification is WEST PENN Cat. No. 25292B or equal as manufactured by BELDEN, CONSULIDATED WIRE, GENERAL CABLE, PAIGE, or TAPPAN.

IV. TRACK AND FIELD AREA SOUND REINFORCEMENT SYSTEM

A. EQUIPMENT RACK

1. This Contractor shall furnish and install a sectional wall mounted Track and Field Area sound reinforcement system equipment rack as shown on the Drawings and as specified herein. The rack shall be ATLAS SOUND Cat. No. WMA24-23 sectional, wall mounting type with a textured black finish providing a minimum of forty-two (42) inches of vertical rack mounting space. The rack shall be complete with a continuous piano hinged front door with a cylinder lock and handle. The track and field sound system equipment rack shall have a sign mounted to the front stating, “Personal Listening Devices Stored Here”. The sign shall be 1/16-inch-thick laminated plastic with 3/16-inch-high white letters on a black background. The following equipment shall be furnished and installed by this Contractor in the rack:

    a) Two (2) dual channel power amplifier suitable for rack mounting with a minimum rating of 600 watts’ continuous sine wave per channel into a four (4) ohm output at twenty (20) Hz to twenty (20) kHz with a maximum 0.1 percent (0.1%) distortion. A power amplifier that will meet this specification is CROWN Model No. CTs-1200 complete with the required number of ATLAS SOUND Model No. AF140 matching

transformers.

b) One (1) PASO Model No. DMS260P ten (10) channel, digital mixer/preamplifier with 27/3501 Rack Mount Kit.

c) One (1) PASO Model No. PM01ML Mic/Line input module

d) One (1) PYLE Model No. PT504 rack mounted stereo AM/FM tuner.

e) One (1) TASCAM Model No. CD-200i, rack mounted CD player with MP3 dock.

f) One (1) WILLIAMS SOUND Model No. PPA T35 personal listening system base station transmitter complete with WILLIAMS SOUND Model No. RPK 005 rack mounting kit and ANT 005 coaxial antennae.

g) The Contractor shall furnish and install in the charging stations, twelve (12) WILLIAMS SOUND Model No. No. PPA R37, seventeen (17) channel personal listening system receivers each complete with WILLIAMS SOUND Model No. EAR 013 single earbud, rechargeable batteries, and belt clip.

h) This contractor shall furnish to the owner's representative, four (4) WILLIAMS SOUND Model NKL 001 neckloops.

i) the Contractor shall furnish and install, one (1) WILLIAMS SOUND Model No. CHG 3512 twelve (12) unit charging station for the personal listening system receivers complete with one (1) ATLAS SOUND Model No. VTD1-16 rack sliding shelf

j) One (1) ATLAS SOUND Model No. ACRL-191 AC power supply module suitable for rack mounting.

k) One (1) ATLAS SOUND Model No. ACS-1 AC power strip.

l) One (1) SHURE "SLX" series UHF Wireless Microphone System complete with Model No. SLX4 wireless receiver complete with rack mounting hardware and detachable antennas

B. Speaker Systems:

1. This Contractor shall furnish and install four (4), horn type loudspeakers of the compound diffraction design rated 15W to 120 watts, 70.0 volts with a frequency response of 90 Hz - 16 kHz and shall include a driver. A horn type loudspeaker that will meet this Specification is COMMUNITY Model No. R.5-66T or equal as manufactured by JBL.

C. Microphones:

1. This Contractor shall furnish to the Owner's representative, one (1) SHURE

Model No. SM58S dynamic cardioid microphones complete with an ON/OFF switch. The microphone shall be furnished by this Contractor complete with a twenty-five (25) foot connector cord with CANNON XLR connectors.

2. This Contractor shall furnish to the Owner's representative, one (1) SHURE Model No. SLX2/SM58 dynamic cardioid wireless handheld microphone, and one (1) SHURE Model No WL183 lapel microphone with SLX1 transmitter. Each complete with an ON/OFF switch and batteries

D. Microphone Stand:

1. This Contractor shall furnish to the Owner's representative, one (1) ATLAS SOUND Model No. DS-2 microphone desk stand.

E. Microphone Outlets:

1. This Contractor shall furnish and install where shown on the Drawings, flush or surface wall and/or ceiling mounted microphone outlets (Type "A") consisting of CANNON "XLR" complete with 3 pin XLR (female) series audio jack of the type required so as to be compatible with the type of microphone cable connector furnished, and a stainless-steel cover plate. A microphone outlet, which meets this Specification shall be as manufactured by CONQUEST AUDIO or approved equal.

2. This Contractor shall furnish and install where shown on the Drawings, flush or surface wall mounted Microphone outlets (Type "B") consisting of one (1) CANNON "XLR", complete with 3 pin XLR (female), series audio jack of the type required so as to be compatible with the type of microphone cable connector furnished, one (1) 3.5mmstereo audio jack (MP3), and a stainless-steel cover plate. A Microphone/MP3 outlet, which meets this Specification shall be as manufactured by CONQUEST AUDIO or approved equal.

F. Track and Field System Cable:

1. This Contractor shall furnish and install speaker cable consisting of one (1) twisted pair, No. 12 AWG unshielded with a temperature range for dry locations of minus twenty-five (25) degrees C to one hundred five (105) degrees C and seventy-five (75) degrees C for wet locations. A cable that meets this Specification is WEST PENN Cat. No. AQ227 or equal as manufactured by BELDEN, CONSULIDATED WIRE, GENERAL CABLE, PAIGE, or TAPPAN.

2. This Contractor shall furnish and install field wiring for microphone outlets as shown on the Drawings. Wiring shall be two (2) conductor, No. 20 AWG stranded and shielded cable. A cable that meets this Specification is WEST PENN Cat. No. 25292B or equal as manufactured by BELDEN, CONSULIDATED WIRE, GENERAL CABLE, PAIGE, or TAPPAN.

3. This Contractor shall furnish and install field wiring for MP3 outlets as shown on the Drawings. Wiring shall be two (2) conductor, No. 20 AWG stranded and

shielded cable. A cable that meets this Specification is WEST PENN Cat. No. 25292B or equal as manufactured by BELDEN, CONSULIDATED WIRE, GENERAL CABLE, PAIGE, or TAPPAN.

Part 3 - Execution

I. INSTALLATION

A. All wiring for the Athletic Fields sound reinforcement systems shall be installed by this Contractor in ½-inch conduit. All junction box covers shall be stenciled for distinct identification. All conduit, device mounting boxes, junction boxes, and enclosures shall be securely fastened with appropriate fittings to insure a positive ground throughout each entire system.

B. All wiring connections shall be made by this Contractor as directed by the equipment manufacturer. Splices for circuits shall be made only in junction boxes and shall be crimp connected.

C. All wiring shall be checked and tested by this Contractor to insure each system is free from grounds, opens, and shorts.

D. All work shall be under the supervision of a factory accredited sound engineer. It shall be the responsibility of the sound engineer and this Contractor to check and inspect this installation to the Architect/Engineer's approval.

II. RACK MOUNTED EQUIPMENT

A. Each Athletic Field sound reinforcement systems' rack mounted equipment shall be installed by this Contractor with the proper adapters, rack mounting kits, brackets, and closure panels for unused spaces. All interconnecting wiring shall be labeled, bundled, secured, and terminated by this Contractor in a neat and professional manner.

B. All rack mounted equipment AC power cords shall be plugged into the rack mounted power strip by this Contractor.

III. SPEAKER MOUNTING

A. This Contractor shall assemble and install all speakers as detailed on the Drawings.

IV. MICROPHONES

A. This Contractor shall unpack and assemble microphones complete with all cables, connectors, and stands and connect ready for operation.

V. MICROPHONE OUTLETS

A. This Contractor shall assemble microphone outlets and install, connect, and label as shown on the Drawings.

VI. CABLES

A. All wiring and cable for the Athletic Fields sound reinforcement systems shall be pulled continuously through conduits without splices or abrasions and shall be terminated at their appropriate devices as shown on the Drawings, specified herein, and as directed by the system supplier. All cables shall be labeled. Input and output cabling shall not be installed in the same raceway.

B. Unless otherwise indicated on the Drawings, all Athletic Fields sound reinforcement systems cable shall be installed in heavy wall schedule 40 PVC conduits, minimum size 3/4, as hereinbefore specified.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include furnishing and installing a locally controlled complete and satisfactorily operating sound system in each of the Dance and Gymnastics Rooms for the pickup, amplification, reproduction, and distribution of voice and/or music to associated loudspeakers within each room.

B. Existing Dance and Gymnastics Rooms sound reinforcement systems equipment may be reused as noted on the Drawings. This Contractor shall exercise extreme care not to damage the equipment while following the instructions on the Drawings. The equipment to be reused shall be protected from construction before, during, and after work has been completed.

III. QUALITY ASSURANCE

A. All equipment described shall be the product of a manufacturer of established reputation and experience produced similar apparatus for a period of at least ten (10) years and shall be able to refer to similar installations now rendering satisfactory service.

B. The Dance and Gymnastics Rooms sound reinforcement systems shall be furnished by a factory authorized distributor certified to design, program, and service the system. The distributor must show evidence of successfully furnishing systems specified for at least five (5) years.

C. All equipment for the Dance and Gymnastics Rooms sound reinforcement systems shall be listed Underwriters Laboratories, Inc. (UL) bear the UL label and shall be installed in accordance with all requirements of the National Electrical Code (NEC), state and local codes, and these Specifications.

D. Each of the Dance and Gymnastics Rooms sound reinforcement systems installation shall be performed under the direct supervision of a factory trained service specialist.

E. Shop drawing submittals are required per SECTION 260500 and shall include the following for review. Submittals not containing all of the information listed below will be rejected.

1. A complete list of equipment for each Dance and Gymnastics Rooms sound reinforcement system shall be furnished indicating the specific quantities to be furnished by this Contractor. The catalog or model number for each module of each system shall be listed next to the quantities. This information shall be furnished in the front of the submittal.

2. A specific description of each of the Dance and Gymnastics Rooms sound reinforcement systems shall be furnished describing each module and how it shall function within each system.

3. A specific drawing shall be furnished of each Dance and Gymnastics Rooms sound reinforcement system equipment rack. Each module shall be shown in its proper location with its terminal designation shown.

4. A data sheet shall be furnished for each module and device. The information shall be highlighted that applies to the particular module or device to be furnished.

5. A detailed diagram showing how to connect each device shall be furnished indicating exact final connection information.

6. A detailed floor plan for each Dance and Gymnastics Room shall be furnished. The plans shall show the locations of all equipment, loudspeakers, and devices and their required interconnections. The interconnections shown shall indicate the number, size, and type of wires as described in this Specification. Loudspeakers shall be zoned as shown on the Drawings. The layout of all Dance and Gymnastics Rooms sound reinforcement system equipment, devices, and conduit routings shall closely follow that shown on the Drawings.

IV. DOCUMENTATION

A. This Contractor shall furnish to the Contractor, one (1) set of "As Built" drawings for each Dance and Gymnastics Room sound reinforcement system depicting the complete field wiring system and component interconnections in each system equipment rack.

B. This Contractor shall furnish to the Contractor, four (4) sets of factory operation and maintenance manuals. These manuals shall include factory service manuals with complete parts lists, wiring and component schematics including circuit diagrams, and all other information necessary for the proper operation, service, and maintenance of each Dance and Gymnastics Room sound reinforcement system.

V. TRAINING

A. This Contractor shall furnish eight (8) hours (total for all rooms) of technical service training to the Owner's technical staff using the factory service manuals previously specified.

B. This Contractor shall furnish eight (8) hours (total for all rooms) of operating and programming training to the Owner's operating staff which shall be delivered in two (2) separate four (4) hours sessions to be scheduled at the Owner's convenience over the warranty period.

C. All training specified herein shall be performed by a factory certified technician.

VI. DESCRIPTION OF OPERATION

A. This Contractor shall furnish and install Dance and Gymnastics Rooms sound reinforcement systems with all conduit, cable, outlets, devices, and equipment as shown on the Drawings and as herein specified to furnish complete systems.

B. Each Dance and Gymnastics Rooms sound reinforcement system shall provide for reception of AM or FM radio broadcasts, the amplification of music and voice, and the reproduction of recorded music or other program materials, and their distribution to all associated speakers within each Dance and Gymnastics Room.

C. Each Dance and Gymnastics Room sound reinforcement system shall accept both the input and output of an external tape recorder.

D. Each Dance and Gymnastics sound reinforcement system shall accept a priority override signal to mute the system when the main building Sound and Intercommunications System activates the priority override function.

VII. SYSTEM TEST AND ACCEPTANCE

A. Prior to the final site visitation this Contractor shall conduct an operating test of each complete Dance and Gymnastics Rooms sound reinforcement system. Each system shall test free from grounds, shorts, and other faults. All connections shall be thoroughly checked for mechanical and electrical connections. All equipment shall be demonstrated to operate in accordance with the requirements set forth in these Specifications and as shown on the Drawings.

B. This Contractor shall perform all tests in the presence of the Architect/Engineer. This Contractor shall furnish all personnel and test instruments for use in the test.

C. When the work on each Dance and Gymnastics Room sound reinforcement system has been completed and is ready for final review, this Contractor shall demonstrate that the requirements of the Contract as it applies to this work have been carried out and that the system has been adjusted and operated in accordance therewith.

VIII. WARRANTY

A. This Contractor shall deliver the work described herein in a first-class operating condition in every respect. This Contractor shall also warrant that the material, equipment, and workmanship furnished shall be entirely free from defects. Any materials, equipment, or workmanship in which defects may develop before or during the warranty period shall be repaired or replaced at the Contractors own expense. Refer to SECTION 01740 for the start of the warranty period. The contractor shall further warrant that all material, equipment, and workmanship used in the installation, but not specifically mentioned in the Drawings and Specifications, is the best of their respective kinds and that the construction and installation was performed in accordance with the best accepted standard practices in all details.

Part 2 - Products

I. EQUIPMENT RACKS

A. This Contractor shall furnish and install in each Dance and Gymnastics Room where shown on the Drawings, a wall mounted equipment rack for the room's sound reinforcement system as specified herein. Each rack shall be ATLAS SOUND Cat. No. WMA24-23 sectional, wall mounting type with a textured black finish providing a minimum of sixty-one (61) inches of vertical rack mounting space. Each rack shall be complete with a continuous piano hinged front door with a cylinder lock and handle. The following equipment shall be furnished and installed by this Contractor in each rack:

1. One (1) TOA Model No. D-901 twelve (12) input, eight (8) output, digital mixer. Mixer shall come complete with:

   a) One (1) D936R four (4) stereo input module (tuner, CD, MP3 outlets).

   b) One (1) D971E four (4) channel line output module (personal listening system, amplifier).

   c) Four (4) D921E 2-channel input modules (microphone/MP3 outlets).

2. One (1) CROWN Model No. CTs 600 dual channel amplifier with three hundred (300) watts per channel at eight (8) ohms. Amplifier shall be suitable for rack mounting.

3. One (1) PYLE Model No. PT504 rack mounted stereo AM/FM tuner.

4. One (1) TASCAM Model No. CD-200i, rack mounted CD player with MP3 dock.

5. One (1) ATLAS SOUND Model No. ACS-1 AC power strip suitable for rack mounting.

II. WALL MOUNTED STEREO SPEAKERS

A. This Contractor shall furnish and install where shown on the Drawings, two (2) JBL Model No "C29AV-1" enclosed wall mounted stereo speakers. The stereo speakers shall be 300 watts, 8 ohms. Each stereo speaker shall be complete with wall mounting bracket.

III. MICROPHONES

A. This Contractor shall furnish to the Owner's representative, two (2) SHURE Model No. SM58S dynamic cardioid microphones for each Dance and Gymnastics Room sound reinforcement system (total of **CONSULTANT SHALL EDIT**). Each microphone shall be furnished by this Contractor complete with a twenty-five (25) foot connector cord with CANNON XLR connectors

IV. MICROPHONE STANDS

A. This Contractor shall furnish to the Owner's representative, two (2) ATLAS SOUND Model No. MS-20 microphone floor stands for each Dance and Gymnastics Room sound reinforcement system (total of **CONSULTANT SHALL EDIT**).

V. MICROPHONE OUTLETS

A. This Contractor shall furnish and install where shown on the Drawings, flush or surface wall and/or ceiling mounted microphone outlets (Type “A”) consisting of CANNON "XLR" complete with 3 pin XLR (female) series audio jack of the type required so as to be compatible with the type of microphone cable connector furnished, and a stainless-steel cover plate. A microphone outlet, which meets this Specification shall be as manufactured by CONQUEST AUDIO or approved equal.

B. This Contractor shall furnish and install where shown on the Drawings, flush or surface wall mounted Microphone outlets (Type “B”) consisting of one (1) CANNON "XLR", complete with 3 pin XLR (female), series audio jack of the type required so as to be compatible with the type of microphone cable connector furnished, one (1) 3.5mmstereo audio jack (MP3), and a stainless-steel cover plate. A Microphone/MP3 outlet, which meets this Specification shall be as manufactured by CONQUEST AUDIO or approved equal.

VI. AM/FM ANTENNA

A. This Contractor shall furnish and install a PIXEL TECHNOLOGIES Model No. AFHD-4 AM/FM and HD antenna complete with: L mounting bracket; weather boot; surge protector; 20dB attenuator; 10dB attenuator; AM/FM separator; U- bolts with washers and nuts; pole mount saddle brackets; F-female to twin-lead adaptor and push-on-F-female to DIN adaptor. This Contractor shall furnish and install a weatherhead, rigid steel conduit mast, and two (2) RG-6 plenum rated cables from the antennas to the tuner located in the sound and intercommunication system equipment rack. This Contractor shall ground the antenna in accordance with the following specification.

VII. DANCE AND GYMNASTICS ROOMS SOUND SYSTEM CABLE

A. This Contractor shall furnish and install one (1) two (2) conductor, No. 12 AWG stranded plenum rated cable with a temperature range for dry locations of minus ten (10) degrees C to sixty (60) degrees C for each stereo speaker. A cable that meets this Specification is WEST PENN Cat. No. 25227B or equal as manufactured by BELDEN, CONSULIDATED WIRE, GENERAL CABLE, PAIGE, or TAPPAN.

B. This Contractor shall furnish and install field wiring for microphone outlets as shown on the Drawings. Wiring shall be two (2) conductor, No. 20 AWG stranded and shielded cable. A cable that meets this Specification is WEST PENN Cat. No. 25292B or equal as manufactured by BELDEN, CONSULIDATED WIRE, GENERAL CABLE, PAIGE, or TAPPAN.

C. This Contractor shall furnish and install field wiring for MP3 outlets as shown on the Drawings. Wiring shall be two (2) conductor, No. 20 AWG stranded and shielded cable. A cable that meets this Specification is WEST PENN Cat. No. 25292B or equal as manufactured by BELDEN, CONSULIDATED WIRE, GENERAL CABLE, PAIGE, or TAPPAN.

Part 3 - Execution

I. INSTALLATION

A. All vertical, low voltage field wiring shall be installed by this Contractor in 1/2-inch conduit and/or surface metal raceway as shown on the Drawings. Conduit fill shall not exceed the conduit space capacity.

B. All horizontal, low voltage field wiring to be installed in areas without a ceiling or in areas without an accessible ceiling shall be installed by this Contractor in 1/2-inch conduit.

C. All horizontal low voltage field wiring to be installed in areas with accessible ceilings shall be installed by this Contractor bundled together and run exposed above the ceilings. Bundles shall be supported by "J" hooks mounted not more than four (4) feet on center. “J” hooks shall be dedicated to the wiring specified in this specification section.

D. All horizontal, low voltage field wiring shall be run at right angles to the building structure.

E. All horizontal low voltage field wiring shall be installed below the roof/floor structural supports (joist, beams, girders, etc.). Wiring installed between the structural supports mentioned above and the roof or floor deck will not be acceptable.

F. All horizontal low voltage field wiring penetrations through new and/or existing walls shall be sleeved. Minimum sleeve size shall be 3/4 inch. All sleeves shall be bushed both sides.

G. All low voltage field wiring for the Dance and Gymnastics Rooms sound reinforcement systems shall be furnished and installed by this Contractor. All junction box covers shall be stenciled for distinct identification.

H. All wiring connections shall be made by this Contractor as directed by the equipment manufacturer. Splices for circuits shall be made only in junction boxes and shall be crimp connected.

I. All Dance and Gymnastics Rooms sound reinforcement systems wiring shall be checked and tested by this Contractor to insure the system is free from grounds, opens, and shorts.

J. All work shall be under the supervision of a factory accredited sound engineer. It shall be the responsibility of the sound engineer and this contractor to check and inspect this installation to the Owner's and Architect/Engineer's approval.

II. RACK MOUNTED EQUIPMENT

A. Each Dance and Gymnastics Room sound reinforcement system's rack mounted equipment shall be installed by this Contractor with the proper adapters, rack mounting kits, brackets, and closure panels for unused spaces. All interconnecting wiring shall be labeled, bundled, secured, and terminated by this Contractor in a neat and professional

manner.

B. All rack mounted equipment AC power cords shall be plugged into the mounted power strip by this Contractor.

III. SPEAKERS

A. Wall mounted stereo speakers shall be securely fastened to the building structure by this Contractor with threaded rod or bolts as appropriate for the application.

IV. MICROPHONES

A. This Contractor shall unpack microphone and assemble with cables and stands and connect ready for operation. Microphones shown for permanent installation shall be mounted by this Contractor in accordance with the Drawings in a manner appropriate for the location.

V. MICROPHONES OUTLETS

A. This Contractor shall assemble microphone outlets and install, connect, and label as shown on Drawings.

VI. ANTENNA INSTALLATION

A. The antenna shall be bracket mounted by this Contractor above the roof at a location approved by the Owner. The antenna cables shall be run by this Contractor to the equipment rack and connected ready for operation.

B. The antenna shall be grounded by this Contractor to the secondary building ground system with one (1) No. 10 AWG in 1/2-inch conduit.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contracts, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include furnishing and installing locally controlled complete and satisfactorily operating classroom amplification system where shown on the Drawings for the pickup, amplification, and reproduction of voice/audio at classroom locations.

III. SUBMITTALS

A. Product Data

1. Submit equipment prints, panel diagrams, full electronic wiring diagrams and specifications sheets for items included herein. Provide a tabulation of the specification clearly comparing the submitted items with the items specified. Specifications shall be submitted for all items

B. Shop Drawings

1. Shop drawings detailing integrated electronic communications network systems including the built in station arrangement and equipment cabinet arrangement.

2. Wiring diagrams detailing power, signal and control.

3. Typical connections for all types of equipment.

4. A riser diagram for the system showing all connections, interconnections and all provisions available for future expandability.

C. Samples

1. Provide a sample of all equipment and components that will be installed in a typical classroom.

IV. QUALITY ASSURANCE

A. Qualifications

1. All items of equipment including wiring and cable shall be designed by the manufacturer to function as a complete system and shall be accompanied by the manufacturer’s complete service notes and drawings detailing all interconnections.

2. The contractor shall be an established communications and electronics contractor that has had and currently maintains a locally run and operated business for a minimum of five years. The contractor shall utilize an authorized distributor of the equipment supplied for this project location with full manufacturer's warranty privileges.

3. The contractor shall show satisfactory evidence that the supplier maintains a fully equipped service organization capable of furnishing adequate inspection and service to the system. The supplier shall maintain at his facility the necessary spare parts to properly service the equipment.

B. All equipment specified herein shall be the product of a manufacturer of established reputation and experience who shall have produced similar apparatus for a period of at least ten (10) years and who shall be able to refer to similar installations now rendering satisfactory service.

C. The classroom amplification system(s) shall be a dynamic FM and digital modulation (DM) type system. Specifically, it must operate in the VHF Band, 216 to 217 MHz (23 narrow band channels) and utilize digital transmission technology in the 2.4 GHz band with automatic frequency hopping to avoid interference issues.

D. The classroom amplification system(s) shall be furnished by a factory authorized distributor certified to design, program, and service the system. The distributor must show evidence of successfully furnishing similar systems for at least five (5) years.

E. All equipment for this system shall be listed by Underwriters Laboratories, Inc. (UL), bear the UL label and shall be installed in accordance with all requirements of the National Electrical Code (NEC), state and local codes, and these Specifications.

F. The classroom amplification system(s) shall be furnished and installed by this Contractor as shown on the Drawings and as specified herein.

G. Shop drawing submittals are required per SECTION 16010 and shall include the following for review. Submittals not containing all of the information listed below will be rejected.

1. A complete list of equipment shall be furnished indicating the specific quantities to be furnished by this Contractor. The catalog or model number for each module of the system(s) shall be listed next to the quantities. This information shall be furnished in the front of the submittal.

2. A specific description of the system(s) shall be furnished describing each module and how it shall function in the system.

3. A data sheet shall be furnished for each module and device. The information shall be highlighted that applies to the particular module or device to be furnished.

4. A detailed diagram showing how to connect the audio hub device to a computer and the CATV system shall be furnished indicating the exact final connection

information.

V. QUALITY ASSURANCE

A. Conditions for Consideration of "Or Equal" Products: Where products are specified by name and accompanied by the term "or equal", the proposed "or equal" product will be considered when the following conditions are satisfied. If all the following conditions are not satisfied, Design Consultant will return requests without action, except to record noncompliance with these requirements:

1. Proposed product does not require extensive revisions to the Contract Documents.

2. With the exception of the product name or number and manufacturer's name, proposed product conforms with requirements indicated on the Drawings and in the Specifications in every respect and will produce indicated results.

3. Proposed product t is fully documented and properly submitted.

4. Proposed product has received necessary approvals of authorities having jurisdiction.

5. Proposed product is compatible with AND has been coordinated with other portions of the Work.

6. Proposed product provides specified warranty.

7. If proposed product involves more than one contractor, proposed product has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

8. Submission is accompanied with detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.

9. Submission is accompanied with a list of similar installations for completed projects with project names and addresses and names and addresses of design consultants and authorities, if requested.

10. Submission is accompanied with proposed product's Manufacturer signed written statement on Manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents

VI. DOCUMENTATION

A. This Contractor shall furnish to the Contractor four (4) sets of factory operation and maintenance manuals. These manuals shall include factory service manuals with complete parts lists, wiring and component schematics including circuit diagrams, and all other information necessary for the proper operation and service maintenance of the system.

VII. TRAINING

A. This Contractor shall furnish eight (8) hours of technical service training to the Owner's technical staff using the factory operation manuals previously specified.

B. This Contractor shall furnish eight (8) hours of operating and programming training to the Owner's operating staff which shall be delivered in two (2) separate four (4) hour sessions to be scheduled at the Owner's convenience over the warranty period.

C. All training specified herein shall be performed by a factory certified technician.

VIII. DESCRIPTION OF OPERATION

A. Each system shall provide for the distribution of voice/audio to associated loudspeaker.

B. Each system shall provide auxiliary inputs for the connection to a computer and/or the building CATV system.

C. Each system shall have the capability to interact with a student’s hearing aid and/or cochlear implant device.

IX. SYSTEM TEST AND ACCEPTANCE

A. Prior to the final site visitation, and acceptance of each construction phased spaces, this Contractor shall conduct an operating test of each complete classroom amplification system. Each system shall test free from grounds, shorts, and other faults. All connections shall be checked for mechanical and electrical connection. All equipment shall be demonstrated to operate in accordance with the requirements set forth in these Specifications and as shown on the Drawings.

B. This Contractor shall perform all tests in the presence of the Architect/Engineer. This Contractor shall furnish all personnel and test instruments required for use in the test.

X. WARRANTY

A. This Contractor shall deliver the work described herein in a first class operating condition in every respect. This Contractor shall also warrant that the material, equipment, and workmanship shall be entirely free from defects. Any materials, equipment, or workmanship in which defects may develop before or during the warranty period shall be repaired or replaced at the Contractors own expense. Refer to SECTION 01740 for the start of the warranty period. The contractor shall further warrant that all material, equipment, and workmanship used in the installation, but not specifically mentioned in the Drawings and Specifications, is the best of their respective kinds and that the construction and installation was performed in accordance with the best accepted standard practices in all details.

Part 2 - Products

I. MANUFACTURER

A. The classroom amplification system(s) shall be as manufactured by PHONAK or approved equal.

II. WALL MOUNTED SPEAKER

A. This Contractor shall furnish and install, wall mounted classroom amplification system speaker where shown on the Drawings and herein specified.

1. One (1) PHONAK Digimaster 5000 wall mounted speaker complete with the following:

a) Wall mounted bracket.

b) 12 speaker-line array

c) Mini USB port

d) 3.5 mm audio input

e) LED status indicating light

f) Power supply with mini USB connection

III. TRANSMITTER

A. This Contractor shall furnish at each classroom amplification wall mounted speaker location shown on the Drawings one (1) PHONAK Inspiro Transmitter complete with the following:

1. Dual transmission mode FM and DM

2. Voice activity detector.

3. One (1) ILapel (lavaliere) microphone.

4. One (1) DynaMic (handheld) microphone

5. LCD display.

6. Belt clip and neck loop.

IV. AUDIO HUB

A. This Contractor shall furnish at each classroom amplification wall mounted speaker location shown on the Drawings one (1) PHONAK Inspiro Audio Hub complete with the following:

1. Two (2) audio inputs.

2. Volume control.

3. Mini-USB charging interface
4. On/off switch
5. Two (2) 3.5mm male to 3.5mm male patch cables. Minimum 10ft. in length.
6. Power supply with mini USB connection

Part 3 - Execution

I. INSTALLATION

A. All work shall be under the direct supervision of an accredited factory sound engineer. It shall be the responsibility of the sound engineer and this Contractor to check and inspect this installation to the Owner's approval.

B. All transmitters, microphones, audio hubs and patch cables shall be properly stored and protected during construction.

II. WALL MOUNTED SPEAKER

A. The classroom amplification system wall mounted speaker(s) shall be installed by this Contractor with the proper adapters, mounting kits, and brackets at 48" above finished floor to bottom of speaker. All interconnecting power wiring shall be secured, and terminated by this Contractor in a neat and professional manner.

III. TRANSMITTER/MICROPHONES

A. This Contractor shall unpack each transmitter and microphone, assemble, connect and make ready for operation.

IV. AUDIO HUB

A. This Contractor shall unpack each audio hub, connect power and 3.5mm patch cables and make ready for operation.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include furnishing and installing a complete and satisfactorily operating wireless master clock and program system as shown on the Drawings and herein specified for selected clock correction and distribution of program signals.

B. The existing master clock and program system shall remain in operation during the construction period until the new system has been installed and tested, ready for operation. After the new system has been placed in operation, the existing system shall be removed as shown on the Drawings.

III. QUALITY ASSURANCE

A. All equipment described herein shall be the product of a manufacturer of established reputation and experience who shall have produced similar apparatus for a period of at least ten (10) years and who shall be able to, upon request, refer to similar installations now rendering satisfactory service.

B. The wireless master clock and program system shall be furnished by a factory authorized distributor certified to design, program, and service the system. The distributor must show evidence of successfully furnishing systems specified for at least five (5) years

C. All equipment for this system shall be listed by Underwriters Laboratories, Inc. (UL), bear the UL label, and shall be installed in accordance with all requirements of the National Electrical Code (NEC), all state and local codes, and these Specifications.

D. The entire wireless master clock and program system installation shall be performed under the direct supervision of a factory trained service specialist.

E. Shop drawing submittals are required per SECTION 260500 and shall include the following for review. Submittals not containing all of the information listed below will be rejected.

1. A complete list of equipment shall be furnished indicating the specific quantities to be furnished by the manufacturer. The catalog or model number for each module of the system shall be listed next to the quantities. This shall be provided in the front of the submittal.

2. A specific description of the system shall be furnished describing each module and how it shall function in the system.

3. A detailed set of floor plans for the complete building shall be furnished showing the locations of all equipment and devices and their required interconnections. The interconnections shown shall indicate the number, size, and type of wires as described in this Specification. The layout of all wireless master clock and program system equipment, devices, and conduit routings shall closely follow that shown on the Drawings.

4. A data sheet shall be furnished for each component and device. The information shall be highlighted that applies to the module or device.

5. A detailed diagram on how to connect each device shall be furnished showing exact hook-up information.

IV. DOCUMENTATION

A. This Contractor shall furnish to the Contractor one (1) set of "As Built" drawings depicting the complete field wiring system and component interconnections.

B. This Contractor shall furnish to the Contractor four (4) sets of factory service manuals. These manuals shall include factory service manuals with complete parts lists, wiring and component schematics including circuit diagrams, and other information necessary for the proper operation and service maintenance of the system.

V. TRAINING

A. This Contractor shall furnish eight (8) hours of technical service training to the Owner's technical staff using the factory service manuals previously specified.

B. This Contractor shall furnish twenty-four (24) hours of operating and programming training to the Owner's operating staff that shall be delivered in six (6) four (4) hour sessions to be scheduled at the Owner's convenience over the warranty period.

C. All training specified herein shall be performed by a factory certified technician.

VI. DESCRIPTION OF OPERATION

A. Transmitter Operation: When power is first applied to the master transmitter, the master transmitter checks for and displays the software version. The master transmitter then checks the position of the switches and stores their position in memory. The master transmitter looks for the GPS time signal. Once the master transmitter has received the GPS time, it sets its internal clock to that time. The master transmitter then starts to transmit its internal time once every second. The master transmitter updates its internal clock every time it receives valid time data from the GPS. The wireless master clock and program system shall be connected to the master clock and program system in the sound and intercommunications system for time and tone synchronization.

B. Analog Clock Operation:

1. Apply power then follow set up procedures detailed in manufacturer’s

instructions.

2. After initial setup, the clock will shut off the receiver. Six times each day, the microprocessor will activate the receiver and starting with the stored channel, it will again look for a valid time signal. If necessary, the clocks will resynchronize to the correct time.

3. If the clock has not decoded a valid time signal a pre-determined number of days, it will go to a step mode.

C. This contractor shall furnish and install, where required, wireless repeater/transmitter(s). The number of repeater/transmitters shall be as needed for a complete, functioning wireless master clock and program system.

VII. SYSTEM TEST AND ACCEPTANCE

A. Prior to the final site visitation, this Contractor shall conduct an operating test of the complete wireless master clock and program system. The system shall test free from grounds, shorts, and other faults. All connections shall be thoroughly checked for mechanical and electrical connections. All equipment shall be demonstrated to operate in accordance with the requirements set forth in these Specifications and as shown on the Drawings.

B. This Contractor shall perform all tests in the presence of the Architect/Engineer and Owner. This Contractor shall furnish all personnel and test instruments for use in the test.

C. When the work on the entire wireless master clock and program system has been completed and is ready for final review, this Contractor shall demonstrate that the requirements of the Contract as it applies to this work have been carried out and that the system has been adjusted and operated in accordance therewith.

VIII. WARRANTY

A. This Contractor shall deliver the work described herein in a first class operating condition in every respect. This Contractor shall also warrant that the material, equipment, and workmanship shall be entirely free from defects. Any materials, equipment, or workmanship in which defects may develop before or during the warranty period shall be repaired or replaced at the Contractors own expense. Refer to SECTION 01740 for the start of the warranty period. The contractor shall further warrant that all material, equipment, and workmanship used in the installation, but not specifically mentioned in the Drawings and Specifications, is the best of their respective kinds and that the construction and installation was performed in accordance with the best accepted standard practices in all details.

Part 2 - Products

I. MANUFACTURER

A. The wireless clock and program system shall be manufactured by PRIMEX WIRELESS,

INC., or approved equal from SAPLING INC.

II. EQUIPMENT

A. General: The wireless master clock and program system shall include a master transmitter, a roof mounted GPS receiver, indicating clocks, and all accessories for complete operation.

B. GPS roof mounted Receiver:

1. The GPS Receiver shall be complete with the antenna in a waterproof case, designed for roof or outdoor mounting. Provide mounting bracket for attachment to roof structure and transmitter connection cable.

C. Master Transmitter: Primex Wireless Model 14400, consisting of wireless transmitter with GPS receiver, a surge suppressor/battery backup, and a mounting shelf. Unit shall obtain current atomic time from satellite. The clock system shall transmit time continuously to all clocks in the system.

1. Transmission:

a) Frequency Range: 72.100 to 72.400 MHz.

b) Transmission Range: one mile, open field.

c) Radio technology: narrowband FM

d) Number of channels: 16

e) Channel bandwidth: 20 kHz maximum

f) Transition mode: one-way communication

g) Data rate: 2 KBps

h) Operating range: 0 degrees C. to 70 degrees C.

2. Transmitter:

a) Transmitter output power: +26 to +30 dBm

b) Frequency deviation: +/- 4 kHz

c) Transmitter power requirements: 120 VAC 60 Hz

d) Internal power requirements: 5 VDC

e) Carrier frequency stability: +/- 20 ppm

3. Transmitter shall have 16 selectable channels to assure interference-free

reception.

4. Transmitter shall have the following switches:

    a) Time zone adjustment switches for all time zones in the world. Includes all Canadian time zones: Eastern, Central, Mountain, Pacific, Alaska, and Hawaii.

    b) Daylight Saving Time bypass switch.

    c) 12-hour or 24-hour display.

5. Antenna shall be 46 inches high, commercial type, Antenna gain shall be < 2.2 dB. Antenna polarization shall be vertical.

6. Transmitter housing shall incorporate a display which shall include the following:

    a) Time readout

    b) AM and PM indicator if 12-hour time display is set

    c) Day and date readout

    d) Indicator for daylight savings or standard time

    e) LED which shall flash red in event of reception problem

    f) GPS reception indicator

7. Transmitter shall contain an internal clock such that failure of reception from the GPS will not disable the operation of the clocks.

D. Power supply (included), Input: 120-volt AC 50/60 Hz, 0.4 amp. Output: 9-volt DC, 1.5 amp.

E. Surge Protector/Battery Backup (included), Input: 120-volt AC 60 Hz +/- 1 Hz., Output: 120-volt AC, 500VA, 300 watts, Surge Energy Rating: 365 joules

F. Additional Equipment

1. Wireless Receiver Switches: Switches shall receive time packets from the Master Transmitter and relay the synchronized time to the Satellite Transmitter connected to it. The unit shall include the following:

    a) Antenna mounted on top of the switch housing, 11-1/2 inches long.

    b) Power Supply: Input 120 VAC 50/60 Hz, 0.4 amps; Output: 9-volt DC, 1.5 amps

    c) RS 232 data cable, 5 feet long

d) Daylight Savings Time bypass switch

e) Dimensions: 4-1/4 inches long, 5/-3/4 inches wide, 1-1/4 inches deep.

f) Weight: 12 ounces

g) Operating Range: 32 degrees F to 158 degrees F (0-70 degrees C)

2. Where wireless analog clocks that are out of range from the master transmitter, this contractor shall furnish and install one (1) Wireless Repeater/Transmitters Primex Wireless Model 14401:

3. Repeater/Transmitters shall receive the signal from the Wireless Receiver Switches and transmit the signal to the devices in its vicinity. The repeater/transmitter shall be installed in a location as agreed upon by the Owner. The unit shall include the following:

a) Antenna shall be 46 inches high, commercial type, Antenna gain shall be <2.2dB. Antenna polarization shall be vertical.

b) Wireless Receiver Switch.

c) Power Supply

d) Input: 120 VAC, 50/60 Hz, 0.4-amp Output: 9-volt DC, 1.5 amps

e) 6-foot cord

f) Surge Suppressor/Battery Backup

g) Mounting Shelf.

h) Approximately one Watt transmission.

i) 72 MHz frequency.

G. This Contractor shall furnish and install where shown on the Drawings analog, wireless clocks. Clocks shall have polycarbonate frame, lexan lens, and two (2) clock locks. Face shall be white. Hour and minute hands shall be black. Analog clocks shall be provided with red sweep hand, 12.5 or 16” inch, 120 VAC with proper cord and cap, and 18-inch pigtail to plug into a single pole, 120-volt clock receptacle. Primex Model 14306 (12 inch), 14339 (16 inch).

1. Analog clocks shall be capable of adjusting for Daylight Savings Time.

2. Time shall be automatically updated from the transmitter 6 times per day.

3. If power is interrupted, the clock will stop until power resumes. Upon resumption of power, the clock will self-correct to the current time.

4. If transmitter stops transmitting valid time signals due to power failure, the clocks will continue to function as accurate quartz clocks until a valid time signal is decoded.

5. Clocks shall have wire guards where indicated on drawings. Primex Model 14131 (12.5 “), 14123 (16”)

III. WIRELESS TONE GENERATOR:

A. This Contractor shall furnish and install Primex Wireless tone generator Model 14002, WT generator, complete with cables and antenna required for complete installation. The tone generator shall be used to connect the wireless clock system to the master clock in the sound and intercommunications system for time and tone synchronization.

B. 9 volt switching power supply (fed from 120-volt line)

C. Switching contacts "Form D", two sets: one normally open, one normally close.

D. Audio Output:

1. Isolation transformer with center tap, 600/150 ohms output impedance

2. Variable output and line level

E. Relay output

F. Test and reset buttons

G. Signal indicator

H. One hundred switch identification codes. Any number of switches for each identification code.

I. Selectable channels: 16

J. 24 programmable events with 7 day selectable operations.

K. Selectable daylight saving time bypass.

L. Selectable automatic channel scanning.

M. Computer programmable through transmitter, with automatic backup, and schedule changes which easy to make.

N. Switching information stored in non-volatile memory in the transmitter and broadcast at regular intervals. Each switch retains its instructions in non-volatile memory.

IV. CLOCK RECEPTACLE

A. Refer to specification section 16130.

Part 3 - Execution

I. INSTALLATION

A. GPS Unit: Install on roof in location indicated, in clear view of the sky. Install unit in location free from standing water, and above accumulations of snow, leaves or debris. Seal cable connection to GPS with cable connection sealant. Any added cable lengths must be protected from outside elements. The GPS unit shall be mounted on the roof. In each case, the GPS unit must have a clear view of the sky. The GPS unit mounted on the roof must be located on a suitable bracket, well above the level of standing or incidental water and drifting snow.

B. Master Transmitter and Wireless Repeater/Transmitter(s):

1. Locate master transmitter where indicated, a minimum of 2 to 3 feet above the floor, away from large metal objects such as filing cabinets, lockers or metal framed walls.

2. Attach GPS receiver to master transmitter using cable.

3. Connect antenna to transmitter(s), using care not to strip threads.

4. Connect power supply to the transmitter(s).

5. Set the channel number on the display to correspond to the FCC license.

6. Plug power supply into electrical outlet.

C. One (1) wireless tone generator shall be located at the Sound and Intercommunications main distribution location (SS-MDEL) to provide activation of schedule tones via relay contacts to the main sound and intercommunications system.

D. Analog clocks (AC): Perform the following operations with each clock:

1. Apply power (120 VAC).

2. Observe clock until valid time signals are received and analog clock adjusts itself to correct time.

3. Install the analog on the wall in the indicated location, plumb, level, and tight against the wall. All wireless system clocks shall be mounted over a flush mounted clock outlet where indicated on floor plans. Analog clocks shall be mounted with two (2) Primex Wireless, Inc. clock locks.

II. FIELD WIRING

A. Local 120 VAC power shall be provided to the system clocks.

B. All clock system connections and wiring shall be made by this Contractor as directed by the equipment manufacturer.

C. All clock system wiring shall be checked and tested by this Contractor to insure the system is free from grounds, opens, and shorts.

III. ON-SITE AS-BUILT DRAWINGS

A. The Contractor shall provide one (1) set of the wireless master clock and program system supplier's as-built drawings for permanent use on-site. The Contractor shall: laminate each page of these drawings; provide a rigid means for mounting such as 1/4-inch thick x two (2) inch wide x width of the drawings through-bolted wood along the left edge of the drawings; furnish and install hanging hooks on the back of the Communications Room door; and hang the bound set of drawings.

END OF SECTION

NOTE: SECTION IS STILL UNDER REVIEW. FINAL COORDINATION SHALL OCCUR WITH PGCPS SECURITY DEPARTMENT.

Part 1 - General

I. Description:

A. Work of this section consists of providing the following. Refer to the drawings for additional information.

1. A complete and fully operational Intrusion Security System including but not limited to: control panel, expander panels, keypads, motion detectors, door contacts.

2. A complete and fully operational IP Camera System (PoE) monitoring interior and exterior of building including but not limited to: Full HD IP color cameras, Servers, PoE switches, patch panels, racks, controllers, software, licenses and dedicated work station for video monitoring.

3. Contractor shall comply with 280511 - LAN Wiring Specifications for installation of PoE switches.

4. A complete and fully operational Card Reader Door Access System (PoE) including but not limited to: PoE IP card readers, controllers, processors, locks.

5. A complete and fully operational Aiphone Video Intercom system including but not limited to: Door station, Master Stations, Software and system integration.

B. Furnish all labor, materials, tools, equipment and services necessary to complete the hardware work, as indicated on the drawings, specified, and as necessary or required to satisfactorily complete the project.

1. Contractor will provide a “Digital Monitoring Products” certified Dealer/Installer to install Intrusion Security System.

2. Contractor will provide a “Genetec” certified Dealer/Installer to install IP Camera System (Poe).

3. Contractor will provide a “Genetec” certified Dealer/Installer to install Door Card Access System (PoE).

C. Related Documents:

1. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 specification section, apply to work of this section.

2. General Electrical Provisions and Basic Materials and methods sections apply to work specified in this section.

II. Submittals:

A. Submit three copies of a complete product data showing all devices to be furnished and the installation location for which it is intended to the Architect for review. A cover sheet shall be made part of the line item device schedule and shall list manufacturer and model number of each device with mounting heights, explanation of abbreviations, symbols, codes, etc. The schedule shall include all items required for all four phases under Security Systems, Intrusion, Cameras, Card Access and Video Intercom. The contractor shall assume sole responsibility for the provisions, proper coordination, installation and operation of completed Security Systems. The Architect's and Owner's review of the submittals and component installation schedule shall not be construed as a complete check, nor shall it relieve the Contractor from responsibility for any errors, deviations or omissions from the requirements needed to satisfactorily complete all four phases of Security System, Intrusion, IP Camera, Card Access and Video Intercom.

B. Manufacture's brochures, technical directives, instructions, and installation manuals.

C. The submittals shall include an itemized equipment list and wiring diagrams

III. Quality Assurance:

A. The Intrusion Security System dealer/installer shall, in the opinion of the Owner, have sufficient comparable experience (not less than five years) and an organization consisting of experienced certified "Digital Monitoring Products" technician status to properly install and program Intrusion Security System in a satisfactory manner. The certified "DMP" dealer/installer shall have in stock at all times sufficient material to take care of shortages and minor extras without delay. The certified "DMP" dealer/installer shall maintain an office/warehouse in the Washington Metropolitan area (75 mile radius) and be readily available to attend job meetings that may be required by the architect, Owner or general contractor. The definition of the Washington Metropolitan area is at the discretion of the Owner, and he reserves the right to exclude.

B. The IP Camera System (PoE) and Card Access System (PoE) dealer/installer shall, in the opinion of the Owner, have sufficient comparable experience (not less than five years) and be a certified "Genectec" partner with certified "Genetec" technicians in order to properly install and program IP Camera and Card Access Systems in a satisfactory manner. The certified "Genetec" partner shall have in stock at all times sufficient material to take care of shortages and minor extras without delay. The certified "Genetec" partner shall maintain an office/warehouse in the Washington Metropolitan area (75 mile radius) and be readily available to attend job meetings that may be required by the architect, Owner or general contractor. The definition of the Washington Metropolitan area is at the discretion of the Owner, and he reserves the right to exclude.

C. The dealer/installer shall examine all drawings, schedules, details and relevant shop drawings, and furnish all hardware for complete and operational Intrusion, Camera, Card Access and Video Intercom Systems. Where practical applications cannot be made with the exact types of hardware requested , obtain the Owner's and Architect's permission to furnish suitable types having the same or equal specifications.

D. All items to be new & in good condition, free of defects. At time of installation all items must be most recent manufacture's model numbers and software are to be used.

E. The dealer/installation company shall show proof of having regular experience with design, installation, service, and maintenance of manufactured systems for a minimum of the last twelve (12) calendar months from the project start date. Each system installer and service person must provide manufacturer certification of technical training for installation, service, and system maintenance. Certification shall be proven with an official document issued by the manufacturer.

F. The dealer/installation company shall provide a minimum of 5 (five) verifiable references from its clients where the manufacturer's system has been installed and or maintained within the last twelve (12) calendar months from the project start date.

G. The dealer/installation company shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Owner, Architect of any discrepancy before performing the work. Materials shall be installed in strict compliance with state and local building and electrical codes. All work shall be performed in accordance with manufacture instructions. Components must be installed by a dealer/installer in good standing that has been is factory-trained by Digital Monitoring Products for Intrusion Security System and Genetec for Camera/Card Access Systems.

H. Prior to the installation, the dealer/installation company and contractor must meet with the Prince George's County Public Schools, Department of Security's Supervisor of Technical Services to review systems installation procedures, zoning device location, and to resolve any concerns regarding equipment installation.

IV. Warranty – See section 16010.

Part 2 - Products

I. General:

A. Furnish and install a complete Intrusion Detection Control system Control Panel With the performance criteria detailed in this specification. The system shall be inclusive of all necessary functions, monitoring, and control capability as detailed herein and on accompanying Shop drawings.

B. All wiring is to be marked with number wire markers at each end and throughout the project. The wire marking information shall match drawing with information being turned over to Prince George's County Public Schools, Department of Security supervisor of Technical Services.

C. Complete Raceway systems of conduit and outlets shall be used between interface junction boxes and area junction boxes and any area where wire would not be accessible upon completion of building.

II. Fire Alarms:

A. The security system shall have relays install in the fire alarm control panel to trip Fire Alarm, Fire Trouble and Fire Supervision signals to the security alarm system control panel.

B. The relays shall be approved for use by the fire alarm manufacture or the owner.

C. One 12 conductor jacketed stranded copper wire in shall be run from Fire Alarm Panel to Security Alarm Panel and wire shall be in conduit.

III. Security Control Panel 574-ZONE PANEL SYSTEM

A. Manufacturer

1. The manufacturer shall have at least thirty-five (35) years of experience in the role of fire and security control manufacturing, and a proven track record of forward and backward compatibility for a minimum of twenty (25) years for its product's auxiliary devices, including system keypads, annunciation devices, zone expansion modules, and addressable detection devices.

2. The manufacturer must also manufacture receiving equipment that is compatible with standard dial-up telephone lines, network, and cellular network monitoring equipment that is compatible with a LAN, WAN, and the Internet. The receiving equipment shall be capable of receiving all status and alarm messages generated by the system. The receiving equipment shall be capable of updating the panel operating program and the system date and time.

3. Commercial/Residential Intrusion detection/Access control /Household Fire Alarm Control Panel equipment manufacturer shall be: Digital Monitoring Products

4. The installing company shall furnish and install a complete electrically supervised DMP panel, as detailed in this specification. The system shall be inclusive of all necessary function, monitoring, and control capability as detailed herein and on accompanying shop drawings.

B. Features

1. 1 Select Area, All/Perimeter, or Home/Sleep/Away operation

2. 32 individual reporting areas, with common areas

3. Up to 16 supervised door access-points and/or keypads

4. 32 character names available for user, zone, area, profiles and group names

5. Up to 4 profiles per user

6. Fully supervised 10/100 network and CDMA/HSPA+ cellular communication

7. Communications Diagnostics check network and cellular communication status from the keypad.

8. Eight communication paths between the panel and Central Station

9. Guest operation allows up to three separate protected systems

10. Flexible system arming features, with Instant Arming option
11. Lock Down operation from keypad or remotely
12. Up to 562 two-wire smoke detector or fire-initiating zones
13. 10,000 user codes with 99 profiles
14. 506 Outputs
15. 12,000 event buffer
16. Built-in phone line monitor
17. Mulch-lingual menus available by user
18. 1.5 Amps 12 VDC smoke and auxiliary output with OVC protection
19. User inactivity audit
20. Easy NetTM connection for the DMP App when used with a network
21. Connection
22. Allow for DMP App, and Central Station connection
23. Cellular backup
24. Up to 500 DMP 1100 Series Wireless or Wired LX Bus
25. Up to 99 schedules for areas, doors, outputs, Z-Wave Favorites, and profiles
26. DMP wireless communication employs 900MHz frequency-hopping spread-spectrum to ensure clear and accurate signal transmissions without interference in practically any environment. Receivers are alerted of transmitters that go missing with Two-Way communication. Each wireless transmitter communicates with the receiver using supervision messages. The on-board LED on all 1100 Series Transmitters provides built-in survey capability to allow for single-person installations, eliminating the Requirement for an external survey kit.
27. Exclusive DMP Wireless features include:

    a) Sensitivity, Pulse Count, Walk Test, & Disarm Disable. Motion sensors can be configured from the panel, allowing for simple, fast, one-person installation. Adjustable sensitivity via panel programming, battery-saving Disarm Disable, Pulse count programming that allows multiple triggers before an alarm is initiated, and Walk Test Mode for sensor setup. WirelessReceivers and repeaters are authorized for wireless Commercial Burglary and Commercial Fire applications. Wireless ONE Button key-fob with PROX Patch

b) The 1145-1-BP is a wearable and portable panic button fob, programmable to function in multiple locations, with alerts for lost fobs, late to test, and lower battery power.

IV. Security Motion Detectors

A. Professional Series TriTech Detectors ISC-PDL1-W18GB Professional Series TriTech Detector Provide PIR and microwave, 18 m x 25 m (60 ft x 80 ft) coverage (10.525 GHz frequency) field selectable to 8 m x 10 m (25 ft x 33 ft) shall be wall mounted on a recessed back box mounted at 102" with a B328 swivel bracket.

1. Description:

a) Professional Series TriTech Detectors are exceptionally suited for commercial indoor applications. Sensor data fusion technology ensures that the detectors send alarm conditions based on precise information. Tri-focus optics eliminate coverage gaps and respond efficiently to intruders. The powerful combination of unique features in the Professional Series delivers superior catch performance and virtually eliminates false alarms. The self-locking two-piece enclosure, built-in bubble level, flexible mounting height, and three optional mounting brackets simplify installation and reduce service time.

2. Sensor Data Fusion Technology

a) Sensor data fusion technology is a unique feature that uses a sophisticated software algorithm to gather signals from five sensors: two pyroelectric sensors, range adaptive radar, a room temperature sensor, and a white light level sensor. The microcontroller analyzes and compares the sensor data to make the most intelligent alarm decisions in the security industry.

3. Tri-focus Optics Technology

a) Tri-focus optics technology uses optics with three specific focal lengths: long- range coverage, middlerange coverage, and short-range coverage. The detector applies the three focal lengths to 86 detection zones, which combine to make 11 solid curtains of detection. Tri-focus optics technology also includes two pyroelectric sensors, which deliver twice the standard optical gain. The sensors process multiple signals to deliver precise performance virtually free of false alarms.

4. Range Adaptive Radar

a) The microwave transceiver automatically adjusts its detection thresholds based on input from the PIR sensors. Integrating the target audience distance information from the PIR significantly reduces false alarms from the microwave Doppler radar.

5. Microwave Anti-mask

a) The detector sends a supervision-trouble signal if microwave reflective material is placed within 30.5 cm (1 ft) of the detector.

6. Supervised Microwave and PIR

    a) The detector provides single technology coverage if the microwave subsystem fails.

7. Active White Light Suppression

    a) An internal light sensor measures the level of light intensity directed at the face of the detector. Sensor data fusion technology uses this information to eliminate false alarms from bright light sources.

8. Field Selectable Coverage (18 m x 25 m or 8 m x 10 m)

    a) Installers can use a DIP switch to select 18 m x 25 m or 8 m x 10 m (60 ft x 80 ft or 25 ft x 33 ft) coverage.

9. Dynamic Temperature Compensation

    a) The detector automatically adjusts PIR sensitivity to identify human intruders at critical temperatures. Dynamic temperature compensation detects human body heat accurately, avoids false alarms, and delivers consistent catch performance at all operating temperatures.

10. Cover and Wall Tamper Switch

    a) When an intruder removes the cover or attempts to separate the detector from the wall, a normally-closed contact opens to alert the control panel.

11. Self-adjusting LED

    a) The LED brightness adjusts automatically to the surrounding light level. A blue light-emitting diode (LED) indicates dual alarms and activates during a walk test. A yellow LED indicates microwave detection, and a red LED indicates PIR detection.

12. Remote Walk Test LED

    a) Users can type a command through a keypad, a control center, or programming software to remotely enable or disable the walk test LED. Users can locally enable or disable the walk test LED through the DIP switch.

13. Alarm Memory

    a) Alarm memory flashes the alarm LED to indicate stored alarms for use in multiple unit applications. A switched voltage from the control panel controls the alarm memory.

14. Solid State Relays

    a) Normally Open Form C Solid State Relay when motion is powered and closes in an alarm condition. Solid state relays send silent alarm output signals to provide a higher level of security and reliability. An external magnet does not activate the relay. The solid state relay uses less current than a mechanical relay, providing longer standby capacity during a power loss.

15. Draft, Insect, and Small Animal Immunity

    a) The sealed optic chamber provides immunity to drafts and insects, reducing false alarms. Small animal immunity reduces false alarms caused by animals less than 4.5 kg (10 lb), such as rodents.

16. Remote Self-Test

    a) Remote self-test initiates when the walk test input switches to its true state. The alarm relay and alarm LED activate for four seconds following a successful test. The trouble relay activates, and the alarm LED flashes following a failed test.

17. Input Power Supervision

    a) When the power is lower than 8 V, a low input power trouble condition activates the trouble relay and causes the LED to flash. The trouble condition clears automatically when power reaches or exceeds 8 V.

18. Trouble Memory

    a) When the walk test input switches to its true state for less than two seconds, LED flashes to indicate the most recent trouble condition. If there is no trouble in memory, the LED does not flash. After twelve hours, or after the detector receives a second walk test pulse for two seconds or less, the LED stops flashing and the trouble memory clears

19. Region Certification

    a) USA UL ANSR: Intrusion Detection Units (UL639)

    b) ANSR7: Intrusion Detection Units Certified for Canada (cULus) [-W18G]

    c) FCC (T3XISC-PDL1-W18G)

20. Mounting Considerations

    a) The recommended mounting height is 102” to the top of recessed back box.

    b) Use B328 Gimbal-mount Bracket Low-profile Swivel-mount Bracket to surface- mount the detector on a flat wall or in a corner.

21. Wiring Considerations

    a) Recommended wire size is 0.2 mm2 to 1 mm2 (26 AWG to 16 AWG).

22. Electrical

    a) Power Requirements

    b) Voltage (Operating): 9 VDC to 15 VDC

    c) Current (Maximum): < 25 mA

    d) Current (Standby): 13 mA

    e) Outputs

    f) Relay: Solid state relay, normally-closed (NC) contacts power supervised.

    g) W, 125 mA, 25 VDC, resistance < 10 Ω.

    h) Tamper: Normally-closed (NC) contacts (with cover on) rated at 25 VDC, 125 Ma maximum.

    i) Connect tamper circuit to 24-hour protection circuit.

    j) Trouble: Solid-state relay normally-closed (NC) contacts.

23. Mechanical

    a) Enclosure Design

    b) Color: White

    c) Dimensions: 136 mm x 69 mm x 58 mm

    d) (5.25 in. x 2.75 in. x 2.25 in.)

    e) Material: High-impact ABS plastic

    f) Indicators

    g) Alarm Indicator: • Blue LED for TriTech alarms

    h) Yellow LED for microwave detection

    i) Red LED for PIR detection Zones

    j) Zones: 86

k) Frequency Information

l) Radio Frequency

m) Interference (RFI) immunity:

n) No alarm or setup on critical frequencies in the range from 26 MHz to 1 GHz at 50 V/m.

24. Environmental

a) Relative Humidity: 0 to 95%, non-condensing

b) Temperature (Operating and Storage): -29°C to +55°C (-20°F to +130°F)

c) For UL certificated installations, 0°C to +49°C (+32°F to +120°F)

d) Environmental Class II EN 50130-5

e) Protection Rating: IP41, IK04 (EN 60529, EN 50102)

B. DUAL TEC MOTION SENSORS X-BAND TECHNOLOGY DT900 Series (with anti-mask)

1. Microcontroller-Based Dual Technology

a) Microwave and passive infrared (PIR) technologies, combined with microcontroller-based advanced signal processing, provide excellent detection while virtually eliminating false alarms and costly service calls.

2. Sensor Sabotage Prevention

a) The DT900 Series uses Active Infrared for anti-masking to detect attempts to mask the sensor. The patented look-down lens catches saboteurs who try to disable the unit from below, while three different tamper switches deter would-be criminals from physically damaging the sensor. The patented INFORMER® function, designed primarily as a diagnostic tool, monitors for sensor blockage and can help identify a sabotage situation.

3. Queue Logic Event Processing

a) The microcontroller in the DT900 converts all incoming microwave and PIR signals from analog-to-digital format. If the signal is determined to be valid it enters the Queue Logic Event Process. This process stores the valid signals within a moving window of time, keeping up to eight events for each signal type. Based on the First In First Out (FIFO) concept, Queue Logic requires a sophisticated on- board microcontroller to make advanced calculations for qualifying a sequence of events as an actual alarm.

4. Self-Test and Continuous Supervision for High Reliability

a) This industrial-grade sensor performs multiple levels of supervision. The INFORMER function checks each technology continuously. The microcontroller conducts a self-test of the sensor's functions at regular intervals, and reports any trouble using the on-board trouble relay.

5. Designed for Harsh Environments

    a) Vandal resistant housing combined with a zero clearance bug guard make the DT- 900 series ideal for commercial and industrial applications such as warehouses, large retail facilities, manufacturing sites and schools.

6. Self-Adjusting Thresholds

    a) The on-board microcontroller automatically adjusts the microwave and PIR thresholds to compensate for environmental disturbances not related to actual intrusion events. True temperature compensation continually optimizes the performance of the PIR to account for changes in room temperature. Environmental noise compensation keeps common environmental disturbances such as fluorescent lights from causing the microwave to false alarm.

7. Technology

    a) PIR for intrusion detection

    b) Microwave for intrusion detection

    c) Active infrared for anti-masking

8. Digital Fluorescent Light Filter

    a) Digital filter virtually eliminates interference caused by fluorescent lighting.

9. Three Microcontroller-based Sensitivity Modes

    a) Sensor sensitivity can be set to high for fastest capture, to normal, or to low for maximum false alarm immunity in harsh environments

10. Sensitivity

    a) Two to four steps within field-of-view, depending on sensitivity setting selected.

11. Zero Clearance Bug Guard

    a) The bug guard provides zero clearance, protecting the pyro chamber from insects that can cause false alarms.

12. Small Animal Immunity

    a) Immune to small animals commonly found in commercial conditions (birds, rodents, snakes).

13. Installer-Friendly Design

    a) Designed with the installer in mind, the DT900 contains a large wiring space, protective clear plastic covers over the circuit boards to prevent damage, two end- of-line terminals, flashed over LEDs visible at great distance, a fast-install wall mounting plate for the included swivel mounting bracket and easy vertical and horizontal adjustment.

14. Mirror Optics For Long Range

    a) The DT900 series utilizes custom designed mirror optics to provide effective capture at long range. Each model is easily selectable between two ranges.

15. LED Diagnostics

    a) The LEDs will display codes to indicate an anti-masking condition, INFORMER condition, trouble condition, and recallable codes to indicate INFORMER results and whether or not there was a self-test failure.

16. Advanced Commercial/Industrial Features

    a) In addition to anti-masking (DT900/DT906), the DT900 Series has command input for initiating a self-test remotely, has CENELEC two wire input options and has a remote LED enable input.

17. DT900 27m (90') Range PIR Fields of View (Edges)

    a) Long: 18

    b) Intermediate long: 18

    c) Intermediate: 16

    d) Intermediate lower: 12

    e) Lower: 8

    f) Look-down: 2

    g) 15m (50') Range

    h) Long: 18

    i) Intermediate long: 16

j) Intermediate: 12

k) Lower: 8

l) Look-down: 2

m) DT900 (anti-mask)

n) 15m x 12m (50' x 40')

o) 27m x 21m (90' x 70')

18. DT906 61m (200') Range PIR Fields of View (Edges)

a) Long: 2

b) Intermediate long: 6

c) Intermediate: 4

d) Intermediate lower: 4

e) Lower: 8

f) Look-down: 2

g) 37m (120') Range

h) Long: 6

i) Intermediate long: 4

j) Intermediate: 4

k) Lower: 8

l) Look-down: 2

m) DT906 (anti-mask)

n) 37m x 3m (120' x 10')

o) 61m x 5m (200' x 15')

C. IP Cameras PoE:

1. Standard Interior Fixed Recess Mount Camera Shall Be Super Dynamic Full HD Dome Network Camera Model WV-SFN631L

a) 1080p Full HD images up to 60 fps*1

b) Approximate 1/3 inches, high sensitivity MOS Sensor

c) Super high resolution at Full HD/1,920 x 1,080 created by high sensitivity MOS Sensor. (WV-SFN631L only)

d) Multiple H.264 (High profile) streams (max. 4 streams) and JPEG streams ensure simultaneous real time monitoring and high resolution recording by new enhanced “UniPhier®”.

e) Maximum Screen Size is 2,048 x 1,536* @30fps, H.264 with use of super resolution techniques.

f) Enhanced Super Dynamic*1 and ABS (Adaptive Black Stretch) technologies deliver 133 dB wide dynamic range.

g) Multi process NR & 3D-DNR to ensure noise reduction.

h) High sensitivity with Day & Night (IR) function: 0.04 lx (Color), 0.01 lx (B/W) at F1.3

i) IR LED equipped: The equipped infrared LED makes it possible to take pictures at zero lx.

j) IR LED is controlled to match the environment; thereby the camera provides clear images of human faces without white blur.

k) Camera attachment bracket that allows easy camera installation toward all four directions.

l) High Speed ABF (Auto Back Focus) and Motorized Zoom.

m) Lens with aperture control function realizes the best focus in any environment.

n) VIQS (Variable Image Quality on Specified area) technology allows the designated eight areas to retain higher image quality while the excluded area will have a decreased image quality, which enables to use lower image file size and bit rate.

o) Cropping function to provide whole image and the part image simultaneously.

p) Up to 4 image capture areas can be specified, and it is also possible to control the sequence.

q) Face Super Dynamic technology to ensure clear face image.

r) Lens distortion compensation for the distorted images can be adjusted 256 steps.

s) Electronic sensitivity enhancement: Auto (Up to 16/30s) / OFF

t) Selectable light control modes:

(1) Outdoor scene, Indoor scene (50 Hz) / Indoor scene (60 Hz), Fix shutter Indoor scene

(2) (50 Hz/60Hz): Flicker caused by fluorescent lightning will be automatically compensated.

u) 3x extra optical zoom at 640 x 360 resolution

v) 2x, 4x digital zoom controlled by browser

w) VMD (Video Motion Detection) with 4 programmable detection areas, 15 steps sensitivity level and 10 steps detection size

x) Privacy Zone can mask up to 8 private areas, such as house windows and entrances/exits.

y) Camera title display: Up to 20 alphanumeric characters on the browser

z) Alarm sources including 3 terminal input, VMD and Camera alarm command can trigger actions such as SDXC/SDHC/SD memory recording, FTP image transfer, E-mail notification, Indication on browser, Alarm terminal output, and Panasonic alarm protocol output.

aa) Full duplex bi-directional audio allows interactive communication between camera site and monitoring site.

bb) JPEG Image compression ratio can be changed by alarm so that higher quality image can be provided.

cc) Prioritized stream control: One of the video streams can be prioritized when multiple recorders or client PCs are accessing the camera so that the recorder or the client PC can maintain the frame rate.

dd) Double SDXC/SDHC/SD Memory card slots for manual recording (H.264 / JPEG), alarm recording (H.264 / JPEG) and backup upon network failure (H.264 / JPEG). Realize long-term recording and auto backup function.

ee) Dome cover provides clearer images above the horizontal. Thereby, it expands the tilting range of the lens.

ff) Face detection function detects the position of human face and the information is sent by XML or video stream.

gg) Intelligent extension software in addition to built-in VMD (Video Motion Detection), alarm function.

hh) Fog compensation function equipped as standard.

ii) HLC (High Light Compensation) technology reduces strong light sources such as vehicle headlights to prevent camera being blinded.

jj) Super Chroma Compensation function realizes a better color reproducibility even in low illumination.

kk) H.264 max. bit rate/client and Total bit rate control allows flexible network traffic management. Frame rate priority mode controls bit rate and compression ratio to provide the specified frame rate.

ll) Internet mode: H.264 images can be transmitted over HTTP protocol.

mm) Multi-language: English / Italian / French / German / Spanish /

nn) Portuguese / Russian / Chinese / Japanese

oo) IPv4/IPv6 protocol supported

pp) Supports SSL, DDNS (viewnetcam, RFC2136)

qq) Still images (JPEG) can be viewed on mobile phones via Internet.

rr) Onvif compliant

ss) Ceiling Mount Bracket: Q105A

tt) Ceiling Mount Bracket: Q174B

uu) Smoke Dome Cover: CF5SA

2. Standard Interior Fixed Wall Mount Camera Shall Be Super Dynamic Full HD Vandal Resistant Dome Network Camera Model WV-SFR631L

a) 1080p Full HD images up to 60 fps*1

b) Approximate 1/3 inches, high sensitivity MOS Sensor

c) Super high resolution at Full HD/1,920 x 1,080 created by high sensitivity MOS Sensor.

d) Multiple H.264 (High profile) streams (max. 4 streams) and JPEG streams ensure simultaneous real time monitoring and high resolution recording by enhanced “UniPhier®”.

e) Maximum Screen Size is 2,048 x 1,536* @30fps, H.264 with use of super resolution techniques.

f) Enhanced Super Dynamic*1 and ABS (Adaptive Black Stretch) technologies deliver 133 dB wider dynamic range.

g) Multi process NR & 3D-DNR to ensure noise reduction.

h) High sensitivity with Day & Night (IR) function: 0.04 lx (Color), 0.01 lx (B/W) at F1.3

i) IR LED equipped: The equipped infrared LED makes it possible to take pictures at zero lx.

j) IR LED is controlled to match the environment; thereby the camera provides clear images of human faces without white blur.

k) Camera attachment bracket allows an easy camera installation toward all four directions.

l) High Speed ABF (Auto Back Focus) and Motorized Zoom.

m) Lens with aperture control function realizes the best focus in any environment.

n) VIQS (Variable Image Quality on Specified area) technology allows the designated eight areas to retain higher image quality while the excluded area will have a decreased image quality, which enables to use lower image file size and bit rate.

o) Cropping function enables to provide whole image and the part image simultaneously.

p) Up to 4 image capture areas can be specified, and it is also possible to control the sequence.

q) Face Super Dynamic technology to ensure clear face image.

r) Lens distortion compensation for the distorted images can be adjusted 256 steps.

s) Electronic sensitivity enhancement: Auto (Up to 16/30s) / OFF

t) Selectable light control modes:

    (1) Outdoor scene, Indoor scene (50 Hz) / Indoor scene (60 Hz), Fix shutter

    (2) Indoor scene (50 Hz/60Hz): Flicker caused by fluorescent lightning will be automatically compensated.

u) 3x extra optical zoom at 640 x 360 resolution

v) 2x, 4x digital zoom controlled by browser

w) VMD (Video Motion Detection) with 4 programmable detection areas, 15 steps sensitivity level and 10 steps detection size

x) Privacy Zone can mask up to 8 private areas, such as house windows and entrances/exits.

y) Camera title display: Up to 20 alphanumeric characters on the browser

z) Alarm sources including 3 terminal input, VMD and Camera alarm command can trigger actions such as SDXC/SDHC/SD memory recording, FTP image transfer, E-mail notification, Indication on browser, Alarm terminal output, and Panasonic alarm protocol output.

aa) Full duplex bi-directional audio allows interactive communication between camera site and monitoring site.

bb) JPEG Image compression ratio can be changed by alarm so that higher quality image can be provided.

cc) Prioritized stream control: One of the video streams can be prioritized when multiple recorders or client PCs are accessing the camera so that the recorder or the client PC can maintain the frame rate.

dd) Double SDXC/SDHC/SD Memory card slots for manual recording (H.264 / JPEG), alarm recording (H.264 / JPEG) and backup upon network failure (H.264 / JPEG). Realize long-term recording and auto backup function.

ee) Dome cover provides clearer images above the horizontal. Thereby, it expands the tilting range of the lens.

ff) Face detection function detects the position of human face and the information is sent by XML or video stream.

gg) Intelligent extension software in addition to built-in VMD (Video Motion Detection), alarm function. hh. Fog compensation function equipped as standard.

hh) Super Chroma Compensation function for a better color reproducibility even in low illumination.

ii) H.264 max. bit rate/client and Total bit rate control allows flexible network traffic management. Frame rate priority mode controls bit rate and compression ratio to provide the specified frame rate.

jj) Internet mode: H.264 images can be transmitted over HTTP protocol.

kk) Multi-language: English / Italian / French / German / Spanish / mm. Portuguese / Russian / Chinese / Japanese

ll) IPv4/IPv6 protocol supported

mm) Supports SSL, DDNS (viewnetcam, RFC2136)

nn) Still images (JPEG) can be viewed on mobile phones via Internet.

oo) Onvif compliant model

pp) Vandal resistant mechanism for high reliability

qq) Ceiling Mount Bracket: Q105A

rr) Ceiling Mount Bracket: Q174B

ss) Smoke Dome Cover: CR1Sional Accessories

3. Standard Exterior Fixed IP Camera Shall Be Super Dynamic Full HD Vandal Resistant & Waterproof Dome Network Camera Model WV-SFV631L a. 1080p Full HD images up to 60 fps

a) Approximate 1/3 inches, high sensitivity MOS image sensor

b) Super high resolution at Full HD/1,920 x 1,080 created by high sensitivity MOS Sensor.

c) Multiple H.264 (High profile) streams (max. 4 streams) and JPEG streams ensure simultaneous real time monitoring and high resolution recording by enhanced “UniPhier®”.

d) Maximum Screen Size is 2,048 x 1,536* @30fps, H.264 with use of super resolution techniques

e) Enhanced Super Dynamic*1 and ABS (Adaptive Black Stretch) technologies deliver 133 dB wider dynamic range.

f) Multi process NR & 3D-DNR to ensure noise reduction.

g) High sensitivity with Day & Night (IR) function: 0.04 lx (Color), 0.01 lx (B/W) at F1.3

h) IR LED equipped: The equipped infrared LED makes it possible to take pictures at zero lx.

i) IR LED is controlled to match the environment, thereby the camera provides clear images of human faces without white blur.

j) Camera attachment bracket allows an easy camera installation toward all four directions.

k) High Speed ABF (Auto Back Focus) and Motorized Zoom ensures easy installation.

l) Lens with aperture control function realizes the best focus in any environment.

m) VIQS (Variable Image Quality on Specified area) technology allows the designated eight areas to retain higher image quality while the excluded area will have a decreased image quality, which enables to use lower image file size and bit rate.

n) Cropping function enables to provide whole image and the part image simultaneously.

o) Up to 4 image capture areas can be specified, and it is also possible to control the equence.

p) Face Super Dynamic technology to ensure clear face image.

q) Lens distortion compensation for the distorted images can be adjusted 256 steps.

r) Electronic sensitivity enhancement: Auto (Up to 16/30s) / OFF

s) Selectable light control modes:

t) Outdoor scene, Indoor scene (50 Hz) / Indoor scene (60 Hz),Fix shutter

u) Indoor scene (50 Hz/60Hz): Flicker caused by fluorescent lightning will be automatically compensated.

v) 3x extra optical zoom at 640 x 360 resolution

w) 2x, 4x digital zoom controlled by browser

x) VMD (Video Motion Detection) with 4 programmable detection areas, 15 steps sensitivity level and 10 steps detection size

y) Privacy Zone can mask up to 8 private areas, such as house windows and entrances/exits.

z) Camera title display: Up to 20 alphanumeric characters on the browser

aa) Alarm sources including 3 terminal input, VMD and Camera alarm command can trigger actions such as SDXC/SDHC/SD memory recording, FTP image transfer, E-mail notification, Indication on browser, Alarm terminal output, and Camera alarm protocol output.

bb) Full duplex bi-directional audio allows interactive communication between camera site and monitoring site.

cc) JPEG Image compression ratio can be changed by alarm so that higher quality image can be provided.

dd) Prioritized stream control: One of the video streams can be prioritized when multiple recorders or client PCs are accessing the camera so that

the recorder or the client PC can maintain the frame rate.

ee) Double SDXC/SDHC/SD Memory card slots for manual recording (H.264 / JPEG), alarm recording (H.264 / JPEG) and backup upon network failure (H.264 / JPEG). Realize long-term recording and auto backup function.

ff) Dome cover provides clearer images above the horizontal. Thereby, it expands the tilting range of the lens.

gg) Face detection function detects the position of human face and the information is sent by XML or video stream.

hh) Intelligent extension software in addition to built-in VMD (Video Motion Detection), alarm function.

ii) Fog compensation function equipped as standard.

jj) Super Chroma Compensation function realizes a better color reproducibility even in low illumination.

kk) H.264 max. bit rate/client and Total bit rate control allows flexible network traffic management. Frame rate priority mode controls bit rate and compression ratio to provide the specified frame rate.

ll) Internet mode: H.264 images can be transmitted over HTTP protocol.

mm) Multi-language: English / Italian / French / German / Spanish / Portuguese / Russian / Chinese / Japanese

nn) IPv4/IPv6 protocol supported

oo) Supports SSL, DDNS (viewnetcam, RFC2136)

pp) Still images (JPEG) can be viewed on mobile phones via Internet.

qq) Onvif compliant model

rr) IP66 rated water and dust resistant. Compatible with IEC60529 measurement standard, Type 4X(UL50), NEMA 4X compliant.

ss) Dehumidification device for use with various weather conditions

tt) Vandal resistant mechanism for high reliability

uu) Ceiling Mount Bracket: Q169A

vv) Smoke Dome Cover: CW7S

ww) Sun Shade: Q7118

4. Standard Exterior PTZ Shall Be Super Dynamic Weather Resistant Full HD / 1,920 x1,080 H.264 Weather Proof Camera featuring Optical 30x zoom and Super Dynamic PTZ Dome Network Camera WV-SW598

    a) 1080p HD images up to 30 fps

    b) 2.4 Megapixel high sensitivity MOS Sensor

    c) Super high resolution at Full HD / 1,920 x 1,080 created by 2.4 Megapixel high sensitivity MOS Sensor

    d) Multiple H.264 (High profile) streams and JPEG streams ensure simultaneous real time monitoring and high resolution recording by “UniPhier®”.

    e) Full frame (Up to 30 fps) transmission at 1,920 x 1080 image size

    f) 30x optical zoom 90x extra optical zoom at 640x360 resolution with 12x digital zoom enabling 1080x zoom.

    g) Super Dynamic and ABS (Adaptive Black Stretch) technologies deliver 128x wider dynamic range.

    h) Face Super Dynamic Range technology to ensure clear face image.

    i) High sensitivity with Day & Night (IR) function: 0.5 lx (Color), 0.06 lx (B/W) at F1.6

    j) VIQS (Variable Image Quality on Specified area) technology allows the designated 2 areas to retain higher image quality while the excluded area will have a decreased image quality, which enables to use lower image file size and bit rate. VIQS can be set on preset position (1 to 8) and except preset.

    k) Digital Noise Reduction: 3D-DNR ensures noise reduction in various conditions.

    l) Progressive scan ensures clear images with less motion blur and no tearing even when the subject is moving.

    m) Electronic sensitivity enhancement: Auto (Up to 16x) / OFF

    n) Selectable light control modes:

        (1) Outdoor scene / Indoor scene (50 Hz) / Indoor scene (60 Hz) / Fix shutter Indoor scene (50 Hz / 60 Hz): Flicker caused by fluorescent lightning will be automatically compensated.

    o) 360 degrees endless Panning

    p) Advanced auto tracking: The camera automatically pans and tilts to

follow a moving subject and keep it in the center of the image.

q) PTZ control can be taken very smoothly on the user friendly GUI with 16 speeds pan/tilt and new “Drag and Zoom” operation enabling finer control.

r) Up to 256 preset positions

s) 360 map shot: 8 thumbnail images at 45 deg. intervals make it simple to direct the camera easily by clicking on a thumbnail.

t) Industrial grade Pan / Tilt / Zoom mechanism for high reliability

u) VMD (Video Motion Detection) with 4 programmable detection areas, 15 steps sensitivity level and 10 steps detection size

v) Privacy Zone can mask up to 32 private areas, such as house windows and entrances/exits.

w) Camera title display: Up to 20 alphanumeric characters on the browser

x) Alarm sources including 3 terminal input, VMD and Camera alarm command can trigger actions such as SDXC/SDHC/SD memory recording, FTP image transfer, E-mail notification, Indication on browser, Alarm terminal output, and Panasonic alarm protocol output.

y) Full duplex bi-directional audio allows interactive communication between camera site and monitoring site.

z) JPEG Image compression ratio can be changed by alarm so that higher quality image can be provided.

aa) Prioritized stream control: One of the video streams can be prioritized when multiple recorders or client PCs are accessing the camera so that the recorder or the client PC can maintain the frame rate.

bb) SDXC/SDHC/SD Memory card slot for manual recording (H.264 / JPEG), alarm recording (H.264 / JPEG) and backup upon network failure (JPEG)

cc) H.264 max. bit rate / client and Total bit rate control allows flexible network traffic management. Frame rate priority mode controls bit rate and compression ratio to provide the specified frame rate.

dd) Internet mode: H.264 images can be transmitted over HTTP protocol.

ee) Multi-language: English / Italian / French / German / Spanish / Russian / Chinese / Japanese

ff) IPv4/IPv6 protocol supported

gg) Supports SSL, DDNS (viewnetcam, RFC2136)

hh) Still images (JPEG) can be viewed on mobile phones via Internet.

ii) Onvif compliant model

jj) IP66 rated water and dust resistant. Compatible with IEC60529 measurement standard.

kk) Dehumidification device for use in various weather conditions

ll) Rain wash coat dome cover

mm) Ambient Operating Temperature: -50 °C ~ +55 °C (- 58 °F ~ 131 °F)

nn) Fog and Sandstorm compensation

oo) AEM (Auto Eyelid Mechanism) offers images that are more natural and easy to watch reducing doubled images when direction of the lens moved above the horizontal.

D. Network Security Appliance (NSA)

1. Network Security Appliance (NSA) Genreal

a) The NSA shall be a stand-alone enterprise class IP-enabled security appliance.

b) The NSA shall come pre-loaded with the following security software:

c) Genetec Omnicast 4.x

d) Genetec Security Center 5.x

e) The NSA shall support seamless unification of IP access control systems (ACS) and IP video management systems (VMS).

f) Functionalities available with the NSA shall include:

g) Configuration of embedded systems such as ACS and VMS systems

h) User management including Microsoft Active Directory integration for synchronizing user accounts and cardholder accounts

i) System status and health monitoring

j) Activity and audit trails

k) Live event monitoring

l) Live video monitoring and playback of archived video

m) PTZ control and digital zoom

n) Camera sequences

o) Video bookmarks

p) Alarm management

q) Incident management

r) Reporting, including creating custom report templates and incident reports

s) Intrusion device and panel integration (live monitoring, reporting, and arming/disarming)

t) Dynamic graphical map viewing

u) The NSA shall be deployed in one of the following types of installations:

v) Stand-alone video management appliance

w) Remote Archiver as part of an Omnicast or Security Center Enterprise installation

x) Stand-alone access control appliance

y) Unified access control and video management appliance

z) The NSA shall support connectivity through federation from the following security systems:

aa) Genetec Security Center

bb) Genetec Omnicast Video Management System

cc) In a stand-alone video management appliance, the NSA shall support simultaneous recording of up to 100 cameras running at 2Mbps per camera.

dd) In a stand-alone access control appliance, the NSA shall support up to 256 access control readers.

ee) In a unified access control and video management appliance, the NSA shall support simultaneous recording of up 50 cameras running at 2Mbps and support up to 128 access control readers.

ff) The NSA is available in 4 hardware flavors distinguishable by their storage and power supply options:

(1) 4 TB of internal storage and non-redundant power supply

(2) 8 TB of internal storage and redundant power supply

(3) 12 TB of internal storage and redundant power supply

(4) 12 TB with RAID5 configuration for an effective storage of 9 TB and redundant power supply

gg) The NSA shall be an open architecture platform allowing connecting to edge devices from various manufacturers.

hh) The NSA shall support video streams supplied from analog cameras via IP encoders or IP cameras digitally encoded in MPEG-4, MPEG-2, MJPEG, H.264, Wavelet or JPEG2000 compression formats.

ii) The NSA shall support industry standard for the interface of IP-based physical security products, such as:

(1) ONVIF

(2) The NSA shall support up to 10 simultaneous client connections for monitoring over any IP network.

(3) All communication between the NSA and the client applications shall be based on standard TCP/IP protocol and shall use encryption when enabled by the administrator.

(4) The NSA shall include a Server Monitoring Service (Watchdog) that continuously monitors the state of the NSA services.The NSA shall support multiple languages, including but not limited to the following: English, French, Arabic, Dutch, German, Italian, Japanese, Korean, Persian, Simplified Chinese, and Spanish.

2. HARDWARE SPECIFICATIONS Network Security Appliance (NSA) Genreal

a) Power Specifications

(1) Power Input: Auto Ranging 100V-240V

(2) Power Consumption: 350W for non-redundant power supply and 400W for redundant power supplies

b) Mechanical Specifications

(1) 1U 19'' rack mount chassis

(2) Dimensions (HxWxD): 1.68” x 19.00” x 26.00” (42.8 x 482.4 x 660.2 mm) (with bezel and rack flange)

(3) Weight: 42.55lbs (19.3 kg)

c) Environmental Specifications

(1) Operating Temperature: 50°F to 95°F (10°C to 35°C)

(2) Storage Temperature: -40°F to 149°F (-40°C to 65°C)

(3) Operating Humidity: 10% to 80% (non-condensing)

(4) Storage Humidity: 5% to 95% (non-condensing)

d) System Component Specifications

(1) Operating System: Windows Embedded Standard 7

(2) CPU: Intel Xeon E5-2403 1.80GHz, 10M Cache, 6.4GT/s QPI, No Turbo

(3) Memory: 4GB Memory (1X4GB), 1333MHz Dual Ranked RDIMM

(4) Peripheral Interfaces:

(5) 1x RS-232

(6) 4x USB 2.0

(7) 1x VGA

(8) 2x GbE ports

(9) Up to 4, 3.5" or 2.5" Hot Plug Hard Drives SAS or SATA drives

(10) Certifications

(11) CE, Class B

(12) FCC, Class B

(13) Warranty

(14) 3-years hardware

E. IP Camera Viewing Work Station:

1. PC Viewing Work Station with Genetec software to be installed in Main Office.

F. Door Access Master Controller

1. Controller (SMC) Synergis Master

a) The SMC is an intelligent IP controller that provides native support of popular security modules from HID Global and Mercury Security, as well

as Assa Abloy IP locks.

2. PoE Device Support

    a) Synergis supports a variety of PoE-enabled devices such as the HID EDGE EVO and Assa Abloy PoE locks, leading to a simplified and cost effective installation.

3. Respond to potential threats by quickly restricting access to specific areas in no time.

4. Active Directory Integration

    a) Centralize the management and synchronization of Windows user accounts with Synergis' user and cardholder accounts and automate cardholder account creation and deactivation.

5. Global Cardholder Management

    a) Efficiently manage cardholders and credentials across multiple sites, create them centrally or at a remote site, and then have them automatically synchronized across one or more locations.

    b) Federation Unify multiple independent Synergis systems under a single virtual system for ease of global access control monitoring, alarm management, and reporting across sites and time zones.

6. Integrated Badge Designer

    a) Create multiple badge templates for cardholders and print either single-sided or dual-sided badges. Custom card sizes, import/ export of badge templates and batch printing are also supported.

7. Built-In Visitor Management

    a) Check-in visitors by entering their information, assigning a new or existing credential, assigning them to a visitor group, and printing a badge. This is all done from an easy enrolment tool. Fully integrated check-in and check-out of visitors.

8. Software Development Kit (SDK)

    a) Develop custom business applications with a mature software development kit. Integrate badging, payroll, enterprise resource planning, human resources management systems (HRMS), or building management systems.

9. Alarm Management

    a) Configure or trigger alarms based on different events and associate each event to specific users and required actions such as acknowledge,

forward, snooze or show the procedure. Capable of handling thousands of alarms per second. Support for hundreds of alarm priority levels with user defined procedures.

10. Mobile Apps and Web Client

    a) Access your Synergis IP access controller system through a range of mobile apps for your smartphone and a Web Client.

11. People Counting and Area Presence Tracking

    a) Get a real-time count of people within one or more specific areas and generate area-presence reports on demand.

G. Door Access PoE Locking Hardware:

1. Assa Abloy Ethernet (PoE) locks

    a) Must be Full compatibility to Security Center Master Controller access control behavior.

    b) Access rules for card holders and card holder groups on door and areas

    c) Unlock schedules (up to 32 schedules per door)

    d) Standard time and Extended grant time for doors

    e) Door relock mode (after door opens or when door closes)

    f) Monitoring of locks running state (Online, Offline)

    g) Unlock schedule overrides and maintenance mode

    h) Magstripes (full track 2)

    i) Contactless cards (up to 37 bits)

    j) 128 IP locks per SMC unit

    k) 2400 credentials per IP lock

    l) Instant awareness of newly enrolled credentials (cardholders).

    m) Instant awareness of inactive/expired cardholders

    n) Instant awareness of inactive/expired/lost/stolen credentials

    o) Live monitoring of lock status, access grant/deny events from Security Desk, including the following events:

        (1) Offline

(2) Battery fail

(3) Deadbolt set/free

(4) Door forced open

(5) Door held open too long

p) Full reporting capability on granted and denied accesses

(1) Cardholder activities

(2) Credential activities

(3) Door activities

(4) Area activities

(5) Data are only available after the next radio contact

q) Offline mode (when SMC is disconnected from the Access Manager)

r) Autonomous mode (when the IP lock is disconnected from SMC)

s) Offline unit logs and Autonomous interface logs

t) Power fail lock settings (Fail Safe/Fail Secure)

u) WiFi radio scheduler (Always on, Daily, or Every x minutes)c N/A

v) Battery checks (Off, Report only, or Daily at a specific time)d N/A

2. Assa Abloy Wi-Fi locks

a) Must be Full compatibility to Security Center Synergis access control behavior.

b) Access rules for cardholders and cardholder groups on doors and areas

c) Unlock schedules (up to 32 schedules per door)

d) Standard time and Extended grant time for doors

e) Door relock mode (after door opens or when door closes)

f) Monitoring of locks running state (Online, Offline)

g) Unlock schedule overrides and maintenance mode

h) Magstripes (full track 2)

i) Contactless cards (up to 37 bits)

j) 128 IP locks per SMC unit

k) 2400 credentials per IP lock

l) Instant awareness of newly enrolled credentials (cardholders).

m) Instant awareness of inactive/expired cardholders

(1) After the next radio contact

n) Instant awareness of inactive/expired/lost/stolen credentials

(1) After the next radio contact

o) Live monitoring of lock status, access grant/deny events from Security Desk, including the following events: Available in reports after the next radio contact

(1) Offline

(2) Battery fail

(3) Deadbolt set/free

(4) Door forced open

(5) Door held open too long

p) Full reporting capability on granted and denied accesses: Data are only available after the next radio contact

(1) Cardholder activities

(2) Credential activities

(3) Door activities

(4) Area activities

q) Offline mode (when SMC is disconnected from the Access Manager)

r) Autonomous mode (when the IP lock is disconnected from SMC)

s) Offline unit logs and Autonomous interface logs

t) Power fail lock settings (Fail Safe/Fail Secure)

u) WiFi radio scheduler (Always on, Daily, or Every x minutes)c

v) Battery checks (Off, Report only, or Daily at a specific time)d

(1) WiFi locks are considered offline only after the periodic radio contact + 5 min. is missed.

(2) The default Power fail lock setting is Fail Secure, meaning the door is locked when power if off. For the configuration of this feature in SMC 2.1 Refer to Genetec specifications.

(3) The default WiFi radio wake up schedule is every day at 0:00 UTC time. For the configuration of this feature in SMC 2.1, refer to Genetec specifications.

(4) The default Battery check schedule is every day at 23:00 UTC time. For the configuration of this feature in SMC 2.1, refer to Genetec specifications. For information on monitoring the battery status, refer to Assa Abloy specifications for "Monitoring the battery status of WiFi locks"

3. Following are acceptable Assa Abloy PoE and WiFi Locks

a) Corbin Russwin Access 700 PIP1 PoE Supported by design

b) Corbin Russwin Access 800 IP1 PoE Supported by design

c) SARGENT Passport 1000 P1 PoE 3_0n08_px_pfm

d) SARGENT Profile Series v.S1 PoE 3_0n08_px_pfm

e) Corbin Russwin Access 700 PWI1 WiFi 3_0n08_px_pfm

f) Corbin Russwin Access 800 WI1 WiFi Supported by design

g) SARGENT Passport 1000 P2 WiFi 3_0n08_px_pfm

h) SARGENT Profile Series v.S2 WiFi Supported by design

H. Video Intercom

1. IS-IPMV IP Master Station at Main Office Secretarial and Administration desks.

2. IS-IPDV IP Video Door Station at Main Entrance Door

I. Visitor Management System

1. Raptor Video Management Software and Hardware installed at Main Office secretarial Desks.

Part 3 - Execution

I. INSTALLATION:

A. The alarm system contractor shall coordinate the installation of all equipment and systems to prevent interference from other building equipment or systems.

B. Alternate locations must be approved by the Security Office representative and the Project Engineer.

C. All detectors shall be securely fastened to the building walls.

D. All wiring shall be installed in conduit where required.

E. When wiring is located above accessible ceilings, conduit may be omitted, but cable must then be run in a neat and orderly fashion. Cable shall be plenum rated, bundled and supported with ties so that there is no sagging. Cable shall also be run under structural or other mechanical and electrical elements such that it is fully accessible over its entire length.

F. All conduit and cable must be concealed above ceilings or within walls.

G. Exposed conduit will be permitted only in unfinished spaces and at the main interface junction cabinet.

II. AS-BUILT DRAWINGS:

A. The alarm installation contractor must provide, directly to the project engineer, a 1/8” scale “as-built” schematic drawing of the complete security system installation indicating:

1. Building layout – interior, exterior floor plan.

2. Room location, names, and numbers.

3. Device equipment connection points, color-coded.

4. Device locations.

5. Interface junction cabinet.

6. Area junction and splice boxes.

III. DEMONSTRATION AND WALK TEST:

A. Upon completion of the security system installation, the alarm system installation contractor will demonstrate the functions and operations to school security system representatives. All devices are to be activated during the test. The Capital Improvement Office will coordinate the demonstration schedule.

B. Upon completion of the security system installation, the alarm system installation contractor will provide a 1/8” scale as-built drawing of the completed security system installation.

C. It is incumbent upon the contractor to have tested all security alarm devices and walk tested the total system prior to the demonstration.

D. Failure of any part of the alarm system will result in a non-acceptance of the installation.

E. Future demonstration walk tests will be done at a time and date convenient to the Security Office.

END OF SECTION

SECTION 28 1000 - ACCESS CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Access control system requirements.

B. Access control units and software.

C. Access control point peripherals, including readers.

D. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 08 7100 - Door Hardware: Electrically operated door hardware, for interface with access control system.

C. Section 26 0526 - Grounding and Bonding for Electrical Systems.

D. Section 26 0533.13 - Conduit for Electrical Systems.

E. Section 27 1000 - Structured Cabling: Data cables for access control system IP network connections.

F. Section 28 2000 - Video Surveillance: For interface with access control system.

G. Section 28 3111 - Building Intrusion Detection: For interface with access control system.

H. Section 28 4600 - Fire Detection and Alarm: For interface with access control system.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 294 - Access Control System Units Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other installers to provide suitable door hardware as required for both access control functionality and code compliance.

2. Coordinate the placement of readers with millwork, furniture, equipment, etc. installed under other sections or by others.

3. Coordinate the work with other installers to provide power for equipment at required locations.

4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Preinstallation Meetings:

1. Conduct meeting with facility representative and other related equipment manufacturers to discuss access control system interface requirements.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Include plan views indicating locations of system components and proposed size, type, and routing of conduits and/or cables. Include elevations and details of proposed equipment arrangements. Include system interconnection schematic diagrams. Include requirements for interface with other systems.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets for each system component. Include ratings, configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed features.

D. Design Data: Standby battery/UPS calculations.

E. Evidence of qualifications for installer.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

G. Manufacturer’s detailed field testing procedures.

H. Field quality control test reports.

I. Maintenance contracts.

J. Project Record Documents: Record actual locations of system components and installed wiring arrangements and routing.

K. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.

L. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

M. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

2. Deliver blank credentials to Owner as directed.

1.06 **QUALITY ASSURANCE**

A. Comply with the following:

1. NFPA 70.

2. NFPA 101 (Life Safety Code).

3. The requirements of the local authorities having jurisdiction.

4. Applicable TIA/EIA standards.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience with access control systems of similar size, type, and complexity and providing contract maintenance service as a regular part of their business; authorized manufacturer's representative.

1.07 **DELIVERY, STORAGE, AND HANDLING**

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.08 **FIELD CONDITIONS**

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 **WARRANTY**

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 **ACCESS CONTROL SYSTEM REQUIREMENTS**

A. Provide new access control system consisting of all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. Surge Protection:

1. Provide surge protection for readers and door strikes/locks.

2. Provide equipment power surge protection where electrical distribution system surge protection is not provided.

C. Access Control Points:

1. See article "ACCESS CONTROL POINT PERIPHERALS" below for device descriptions.

D. Computers Required:

1. See article "ACCESS CONTROL UNITS AND SOFTWARE" below for product descriptions.

2. Server(s):

3. Workstation Computer(s):

4. Badging Station Computer(s):

E. Interface with Other Systems:

1. Provide products compatible with other systems requiring interface with access control system.

F. Provide products listed, classified, and labeled as suitable for the purpose intended.

1. Access Control Units and Readers: Listed and labeled as complying with UL 294.

2.02 **ACCESS CONTROL UNITS AND SOFTWARE**

A. Provide access control units and associated software compatible with readers to be connected.

B. Computers:

1. Workstation Computers: Unless otherwise indicated, workstation computer hardware and associated peripherals not furnished by access control system manufacturer to be provided by Contractor as part of work of this section, meeting access control system equipment manufacturer's recommended requirements.

2. Servers: Unless otherwise indicated, server hardware and associated peripherals not furnished by access control system manufacturer to be provided by Contractor as part of work of this section, meeting access control system equipment manufacturer's recommended requirements.

3. Badging Peripherals: ~~Unless otherwise indicated, badging peripherals not furnished by access control system manufacturer to be provided by Contractor as part of work of this section.~~ Delineation

of Responsibilities to provide the following have been addressed in the *RFP* and *supporting exhibits* with regards to Badging Peripherals.

a. Basis of Design Product(s):

1) Badging Printer:

2) Badging Camera:

3) Badging Signature Tablet:

C. Software:

1. Unless otherwise indicated, provide all software and licenses required for fully operational system.
2. Access Control System:
3. Visitor Management System:

2.03 ACCESS CONTROL POINT PERIPHERALS

A. Provide devices compatible with control units.

B. Provide devices suitable for operation under the service conditions at the installed location.

C. Provide readers compatible with credentials to be used.

D. Reader Color: To be selected by Architect from manufacturer's available standard colors.

E. Contactless Smart Card Readers:

1. Utilizes 13.56 Mhz RF communication with compatible credentials.
2. Utilizes 64 bit authentication keys.
3. Supports ISO compliant credentials.
4. Supports data encryption.

F. Biometric Readers:

G. Proximity Readers:

1. Utilizes 125 kHz RF communication with compatible credentials.

H. Wiegand Readers:

I. Keypads:

J. Bar Code Readers:

K. Door Position Switches:

1. Magnetic Contacts: Encapsulated reed switch(es) and separate magnet; designed to monitor opened/closed position of doors.

L. Request to Exit Devices:

1. Motion Sensors: Passive infrared.

M. Door Locking Devices (Electric Strikes and Magnetic Locks): Comply with Section 08 7100.

2.04 ACCESSORIES

A. Provide components as indicated or as required for connection of access control system to devices and other systems indicated.

B. Unless otherwise indicated, credentials to be provided by Contractor.

1. Provide credentials compatible with readers and control units/software to be used.

C. Unless otherwise indicated, network switches required for network connections to system components to be provided by Contractor.

D. Provide cables as indicated or as required for connections between system components.

1. Data Cables for IP Network Connections: Unshielded twisted pair (UTP), minimum Category 5e, complying with Section 27 1000.

E. Provide accessory racks/cabinets as indicated or as required for equipment mounting.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings and configurations of system components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive system components.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to system.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install access control system in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Wiring Method: Unless otherwise indicated, use cables (not in conduit).

1. Use suitable listed cables in wet locations, including underground raceways.
2. Use suitable listed cables for vertical riser applications.
3. Use listed plenum rated cables in spaces used for environmental air.
4. Install wiring in conduit for the following:
    a. Where required for rough-in.
    b. Where required by authorities having jurisdiction.
    c. Where exposed to damage.
    d. Where installed outside the building.
    e. For exposed connections from outlet boxes to devices.
5. Conduit: Comply with Section 26 0533.13.
6. Conceal all cables unless specifically indicated to be exposed.
7. Use power transfer hinges complying with Section 08 7100 for concealed connections to door hardware.
8. Cables in the following areas may be exposed, unless otherwise indicated:
    a. Equipment closets.
    b. Within joists in areas with no ceiling.
9. Route exposed cables parallel or perpendicular to building structural members and surfaces.
10. Do not exceed manufacturer's recommended maximum cable length between components.

D. Provide grounding and bonding in accordance with Section 26 0526.

E. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

F. Identify system wiring and components in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.

C. Prepare and start system in accordance with manufacturer's instructions.

D. Program system parameters according to requirements of Owner.

E. Test for proper interface with other systems.

F. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

G. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.04 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.

D. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of four hours of training.
3. Instructor: Manufacturer's authorized representative.
4. Location: At project site.

3.06 PROTECTION

A. Protect installed system components from subsequent construction operations.

3.07 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide to Owner, a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of access control system for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

C. Conduct site visit at least once every three months to perform inspection, testing, and preventive maintenance. Submit report to Owner indicating maintenance performed along with evaluations and recommendations.

D. Provide trouble call-back service upon notification by Owner:

   1. Include allowance for call-back service during normal working hours at no extra cost to Owner.

   2. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

END OF SECTION

SECTION 28 4600
FIRE DETECTION AND ALARM SYSTEM

PART 1 GENERAL

1.01 REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

1.02 SCOPE

A. The work covered under this Section shall include engineering, designing, testing, furnishing and installing a complete and operable addressable type analog fire detection and alarm system with voice activation shown on the Drawings and herein specified. The system shall include, but not be limited to: control panel including backbox; remote graphic annunciator panel including backbox; alarm initiating and indicating peripheral devices; outlet boxes; conduit; line and low voltage wiring; and all accessories required.

B. The existing fire detection and alarm system shall remain in operation during the construction period until the new system has been installed, tested, and approved by the Prince George's County Fire Marshal and the Owner. The existing system shall then be removed as shown on the Drawings.

1.03 QUALITY ASSURANCE

A. All devices and equipment for this system shall be listed by the Underwriter's Laboratories, Inc. (UL), bear the UL label and shall conform to the applicable sections of National Fire Protection Association (NFPA) 72 and 90A, and the Americans with Disabilities Act (ADA) Code of Federal Regulation.

B. The installation shall be in accordance with all requirements of NFPA, the National Electrical Code (NEC), all state and local codes and requirements, and these Specifications.

C. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.

D. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

E. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level III technician.

F. This Contractor shall furnish shop drawings submittals for all components of this system in accordance with SECTION 16010 of these specifications. Submittals shall include the following for review. Submittals not containing all of the information listed below will be rejected.

1. A complete list by model number of each component of the system with a statement of how many pieces of each model are to be furnished and a listing of the specific data sheet.
2. A description of the system as it functions by component in the system using model numbers where applicable.
3. A complete battery calculation listing by module for the system.
4. A data sheet shall be furnished for each component of the system. The specific information shall be highlighted.
5. A detailed drawing of the control panel shall be furnished showing all modules in their specific location with the specific terminal terminations shown.
6. A detailed set of floor plans for the complete building shall be furnished showing the locations of all equipment and devices, their addresses, and their required interconnections. The interconnections shown shall indicate the system manufacturer's recommended number, size, and type of wires as described in this Specification. The plans shall show the locations of all required control and monitor modules and their addresses. The layout of all fire detection and alarm system equipment, devices, and conduit routings shall closely follow that shown on the Drawings.
7. A detailed drawing shall be furnished of each type of device showing the exact terminal designations.
8. A detailed list shall be furnished of each type of device in the system stating its program function in the system.

9. A detailed list shall be furnished of the relays in the system and their program function.
10. A detailed manufacturer's drawing shall be furnished of the graphic annunciator panel, as it shall appear on the wall in the location of its installation.
11. Certification by the equipment distributor of the required service response time.

G. Following review of the submittals by the Architect/Engineer and Owner, and prior to release of the fire alarm equipment, this Contractor shall submit to the Prince George's County Fire Marshal's office all copies of the corrected submittals for review, comment, and approval. This contractor shall not release any equipment prior to receiving the Prince George's County Fire Marshall approved shop drawing. This contractor shall be responsible for paying all fees associated with the Fire Marshall's review.

H. The installation of all equipment and the final connection of all components and wiring shall be performed under the direct supervision of the system manufacturer's technical staff.

I. Upon completion, the system shall be thoroughly tested by this Contractor to assure proper interfacing of all components.

J. Prior to final inspection, this Contractor shall furnish to the prime Contractor, five (5) copies of the manufacturer's submittal drawings up-dated to reflect: any and all revisions to the system made during construction; and the final addresses of all devices. A printed list of system devices, which will include the following: device type, address, and custom message.

K. The equipment to be furnished by this Contractor under these Specifications shall be the standard product of one manufacturer. Acceptable manufacturers shall be engaged in the manufacture of multiplexed fire alarm equipment for at least seven (7) years and have a fully equipped, factory trained and authorized service organization that will have a response time of four (4) hours or less to the job site The acceptable manufacturers shall be non-proprietary systems as follows Fire Lite,Silent Knight.

L. The fire detection and alarm system shall be furnished by a factory authorized distributor certified to design, program, and service the system. This distributor must show evidence of successfully furnishing systems as specified for at least five (5) years. This distributor shall provide twenty four (24) hour, seven (7) day a week (including holidays) service capability with a maximum four (4) hour response time. This distributor shall provide certification of this capability as part of the submittals.

M. This contractor shall furnish to the Owner the following keys in the quantities indicated.
1. Fire Alarm Annunciator Panel Access – Two (2)
2. Fire Alarm Annunciator Control Switches – Five (5).
3. Fire Alarm Control Panel – Five (5)
4. Manual Station - One per device.

1.04 DESCRIPTION OF SYSTEM

A. The fire detection and alarm system shall be individual point addressable, general alarm, electrically supervised, continuously sounding temporal tone signal with audible and visual alarm and trouble indications.
1. Each individual alarm initiating device shall report to the control panel as a separate "address".
2. The remote graphic annunciator panel's fire zone, and sprinkler zone boundaries shall be in accordance with the Prince George's County's regulations and the Architect/Engineer's detail on the Drawings.

B. Activation of a manual fire alarm pull station; automatic smoke, heat detector; kitchen hood extinguishing system; or waterflow switch shall cause the following:
1. All audible/visual-signaling devices shall sound continuously having a temporal tone signal until manually silenced. A subsequent alarm received after silencing shall again cause the alarm indicating circuits to be activated. The fire alarm signals shall be distinctive from all other alarm signals and shall be clearly audible throughout the entire building.
2. The appropriate alarm source indicating lamps shall energize on the remote graphic annunciator panel and indicate type of device and geographic fire zone. Graphic annunciator panel lamps, when lighted, shall be constantly illuminated. Flashing lamps will not be acceptable.
3. Auxiliary contacts shall activate the security intrusion system to PGCPS Remote Station.
4. Operation of any intelligent thermal detector in the elevator machine room and/or elevator shaft shall automatically shut down the associated elevator.

5. Close all normally held-open smoke doors.
6. Visually indicate via the integral control panel LCD display, the addressable device in alarm. When the control panel goes into the alarm condition: the ALARM (red) LED shall light; the internal control panel alarm shall sound; and the first line of the minimum eighty (80) character LCD shall indicate the REAL TIME, the number of MESSAGES WAITING, and the TIME THAT THE ALARM OCCURRED. The second line shall display the TYPE OF ALARM and the ALARM ZONE NUMBER. The third and fourth lines shall display the user specified message. In order to reduce false alarms, all inputs shall be capable of alarm verification. The system shall be capable of setting the sensitivity of all analog detectors by point and shall be capable of displaying the analog value of the detector by device and/or traditional input and vectoring the value to a remote printer. The system shall automatically identify any analog detector which becomes dirty (maintenance alert) prior to false alarming.

C. Activation of a sprinkler valve tamper switch; dry pipe HI/LO air; air duct type detector; fire pump fault; or generator fault shall cause the following:
   1. The appropriate amber alarm source indicating lamp shall energize on the remote graphic annunciator panel and the integral audible trouble signal shall sound.
   2. Auxiliary contacts shall activate the security intrusion system to PGCPS Remote Station.
   3. Visually indicate via the integral control panel LCD display, the addressable sprinkler valve tamper switch, dry pipe HI/LO air, air duct type detector, fire pump fault, or generator fault in alarm. When the control panel goes into the alarm condition: the NORMAL (green) LED shall extinguish; the SUPERVISORY (amber) LED shall light; and the internal control panel alarm shall sound which shall be distinct from all other alarm sounds. The first line of the minimum eighty (80) character LCD shall indicate the REAL TIME, the number of MESSAGES WAITING, and TIME THAT THE ALARM OCCURRED. The second line shall display the TYPE OF ALARM and the ALARM ZONE NUMBER. The third and fourth lines shall display the user specified message. In order to reduce false alarms, all inputs shall be capable of alarm verification.
   4. Operation of any air duct type smoke detector shall automatically shut down the associated air-handling unit and units which serve the same area, such as gymnasiums, cafeteria, auditoriums, etc.

D. The system, including the remote graphic annunciator panel, shall remain in alarm condition until the initiating device is reset to normal and the control panel is reset. System reset shall be accomplished on a single key-operated switch on the remote graphic annunciator panel.

E. The system shall use 120-volt commercial power as its normal source of power. Upon failure of the normal source, the system shall automatically transfer to the standby power supply which shall be capable of supporting all system supervisory functions for all initiation circuits for a period of twenty four (24) hours and five (5) minutes in as required by NFPA 72A.

F. In the event of failure of operating power, an open, or ground condition on the system wiring, the trouble signals (both audible and visual) shall actuate at the remote graphic annunciator panel. It shall be possible to silence audible trouble signals by means of silencing switches; however, it shall not be possible to extinguish the visual signals until the disarrangement has been corrected. Upon correction of the trouble condition, the system automatically resets the trouble indication. Alarm or trouble indication shall cause an auxiliary contact operation connected to the security system Field Interface Device.

1.05 **TESTING**

A. Upon final completion of the installation, and acceptance of each construction phased space, and after satisfactory testing of the system by this Contractor in the presence of the equipment supplier, this Contractor shall test the system in the presence of the Architect/Engineer, Fire Marshall, Owner, and other authorities having jurisdiction. The manufacturer shall furnish to the Owner a two (2) year contract effective from the date of acceptance, for maintenance and inspection service of the manufacturers' equipment. The manufacturer shall maintain an adequate supply of spare parts for ten (10) years, and shall provide supervision of the installation. The manufacturer and/or their distributor shall provide twenty-four (24) hour/seven (7) day (including holidays) service to the system as hereinbefore described.

1.06 **WARRANTY**

A. This Contractor shall deliver the work described herein in a first-class operating condition in every respect. This Contractor shall also warrant that the material, equipment, and workmanship furnished shall be entirely free from defects. Any materials, equipment, or workmanship in which defects may develop before or during the warranty period shall be repaired or replaced at the Contractor's own expense. Refer to SECTION 01740 for the start of the warranty period. The contractor shall further warrant that all material, equipment, and workmanship used in the installation, but not specifically mentioned in the Drawings and Specifications, is the best of their respective kinds and that the construction and installation was performed in accordance with the best accepted standard practices in all details.

B. It is the intention of this Specification that a complete life-safety system be furnished from a single manufacturer. Equipment shall be UL listed for fire alarm use.

1.07 **INSTRUCTION AND MANUALS**

A. The equipment manufacturer shall provide eight (8) hours of instruction to the Owner's maintenance personnel and shall furnish three (3) complete field service manuals.

1.08 **SPARE PARTS**

A. This Contractor shall furnish to the Owner spare parts as follows. Spare parts shall be furnished prior to the installation of the system.
   1. Two (2) intelligent smoke detectors including bases.
   2. Two (2) intelligent thermal type detectors including bases.
   3. Four (4) intelligent control modules.
   4. Four (4) intelligent monitor modules.
   5. Two (2) manual pull stations and intelligent monitor modules for each.
   6. Six (6) audio/visual alarm signals.
   7. Two (2) exterior alarm signals including surface mounted weatherproof back boxes.
   8. Four (4) visual only alarm signals

PART 2 - PRODUCTS

2.01 **NEW MAIN CONTROL PANEL**

A. The control panel shall be modular for ease of installation, maintenance, and configuration. The control panel controller shall have an eighty (80) character alphanumeric display that offers four (4) twenty (20) character lines.

B. The control panel shall differentiate between long term drift above the pre-alarm threshold (maintenance alert, indicative of the need for cleaning) and a fast rise above the pre-alarm threshold (indicative of a smoldering fire). The maintenance alert shall be annunciated as an alert on the LCD only and shall not be confused as a trouble or an alarm. The unit shall contain a display module of the membrane style construction with a four (4) line by twenty (20) character liquid crystal display (LCD). The LCD shall use super-twist technology and backlighting for high contrast visual clarity. In the normal mode, the LCD shall display the TIME, the TOTAL NUMBER OF ACTIVE EVENTS, and the TOTAL NUMBER OF DISABLE POINTS. In the alarm mode, the LCD shall display the TOTAL NUMBER OF EVENTS, and the TYPE OF EVENT ON DISPLAY. Forty (40) characters of display space shall be reserved for the user's custom messages. The module shall have visual indicators for the following common control functions: AC POWER; ALARM; SUPERVISORY, TROUBLE, DISABLE, GROUND FAULT, CPU FAILURE, and TEST. There shall be common control keys and visual indicators for: RESET; ALARM SILENCE; TROUBLE SILENCE; DRILL; and one (1) custom programmable key/indicator. The module shall include four (4) pairs of display control keys for selection of event display by type (alarm, supervisory, monitor, and trouble) and forward- backward scrolling through event listings. The operation of these keys shall be integrated with the related common control indicators to flash the indicators when undisplayed events are available for display and turn-on steady when all events have been displayed. The module shall allow the first event of the highest priority to capture the LCD for display so that arriving fire fighters can view the first alarm event "hands free". The module shall provide the following system function keys: STATUS; REPORTS; ENABLE; DISABLE; ACTIVATE; RESTORE; PROGRAM; and TEST. The module shall have a numeric keypad, zero (0) through nine (9), with delete and enter keys.

C. During the normal state, the NORMAL (green) LED shall flash, the first line of the LCD shall display the time in (HH:MM:SS) as well as the number of active points and the number of disabled points in the system. When the control panel goes into the alarm condition, the first line of the minimum eighty (80) character LCD shall indicate the REAL TIME; the NUMBER OF MESSAGES WAITING; and TIME THAT THE ALARM OCCURED. The second line shall display the TYPE OF ALARM and the ALARM ZONE NUMBER. The third and fourth lines shall be dedicated to user specified messages. To silence audible devices the operator shall press the ALARM SILENCE button. A new alarm shall cause the audible devices to resound. To reset the network the operator shall press the RESET button.

D. The control panel controller shall contain a RS232 printer/programming port for programming locally via a personal computer or down loading through modems from a remote personal computer.

E. The main controller shall be supervised, site programmable, and of modular design supporting up to ninety six (96) detectors and ninety four (94) remote modules, and two (2) notification appliance circuits (NAC). Additional support for expansion modules shall be provided to add an additional ninety six (96) detectors and ninety four (94) modules including two (2) additional NAC circuits. The NAC shall be convertible to power risers to serve remote multiple NAC modules for zoned signal applications. The system shall have built-in automatic system programming to automatically address and map all system devices attached to the main controller. A minimum default single stage alarm system operation shall be supported with alarm silence, event silence, drill, lamp test, and reset common controls. The system shall support distributed processor intelligent detectors with the following operational attributes: integral multiple differential sensors; automatic device mapping; electronic addressing; environmental compensation; pre-alarm; dirty detector identification; automatic day/night sensitivity adjustment; normal/alarm LED's; relay bases; sounder bases; and isolator bases. Systems, which only monitor the presence of a conventional detector in an addressable base, shall not be acceptable.

F. Each intelligent loop card shall contain its own dedicated resident central processor unit (CPU) and shall provide power, process, store, control, and communicate with detectors and in/out modules via a minimum No. 18 AWG twisted pair cable up to a maximum of 5,000 feet. The cable shall be computer grade.

G. The system shall use full digital communications to supervise all addressable loop devices and power supplies for placement, correct location, and operation. It shall allow swapping of "same type" devices without the need of addressing and impose the "location" parameters on replacement devices. It shall initiate and maintain a trouble if a device is added to a loop and clear the trouble when the new device is mapped and defined into the system. System circuits shall be configured as follows: addressable analog loops Class **; initiating device circuits Class ; notification appliance circuits Class ; network communications ; and annunciator communications . The system shall have an U.L. listed detector sensitivity test feature, which shall be a function of the smoke detectors and performed automatically every four (4) hours. The system shall support one hundred percent (100%) of all remote devices in alarm. All panel modules shall be supervised for placement and return trouble if damaged or removed. The system shall have a CPU "watchdog" circuit to initiate trouble should the CPU fail. The system evacuation signal rate shall be continuous. The system shall include a signal silence inhibit and an automatic signal silence timer. Audible notification and visual signal appliances shall be affected by signal silence features. For NFPA Style 4 operation, branch circuits (T-Taps) may be made off the loop. The number of T-Taps shall not exceed the manufacturer's recommendations.**

H. The average time to detect an alarm shall be three (3) seconds or less. The polling time for the system shall remain the same regardless of the number of intelligent loops in the system up to its maximum.

I. The control panel network master shall have the following features without any changes in hardware or firmware:

1. Five hundred seventy six (576) event history log stored in RAM including, but not limited to, facility name, licensee, project compile date, compiler version, project revision, and time and date of history request.
2. Logics statements.
3. Time controls.
4. Sequences.
5. Actions.
6. Weekday/holiday schedules.
7. Analog value reporting of all analog detectors.
8. Maintenance reporting by intelligent detector.
9. Sensitivity setting changed by detector (within UL limits).
10. Sensitivity setting changed by time (Day/Night Mode).
11. Alarm verification by point or zone (0 to 60 seconds in intervals of 5 seconds).
12. Up to ninety nine (99) priorities for any event driven relay/output.
13. Enabling and disabling of any system device.
14. Ground fault detection on all system devices and inputs.
15. Opens detected on all system devices and inputs.

2.02 **INTELLIGENT PERIPHERAL REQUIREMENTS**

A. This Contractor shall furnish and install intelligent devices as shown on the Drawings and herein specified. All remote intelligent devices shall have a microprocessor with non-volatile memory to support their functionality and serviceability. Each device shall store as required for its functionality the following data: device serial number; device address; device type; personality code; date of manufacture; hours in use; time and date of last alarm; amount of environmental compensation left/used; last maintenance date; job/project number; current detector sensitivity values; diagnostic information (trouble codes); and algorithms required to process sensor data and perform communications with the loop controller. Each device shall be capable of electronic addressing either automatically or application programmed assigned, to support physical/electrical mapping and supervision by location. Setting a device's address by physical means shall not be necessary.

B. The intelligent detectors shall be capable of full digital communications using both broadcast and polling protocol. Each detector shall be capable of performing independent fire detection algorithms. The fire detection algorithm shall measure sensor signal dimensions, time patterns, and combine different fire parameters to increase reliability and distinguish real fire conditions from unwanted deceptive nuisance alarms. The devices shall eliminate by digital filters, signal patterns that are not typical of fires. Devices not capable of combining different fire parameters or employing digital filters shall not be acceptable. Each detector shall have an integral microprocessor capable of making alarm decisions based on fire parameter information stored in the detector head. Distributed intelligence shall improve response time by decreasing the data flow between detector and analog loop controller. Detectors not capable of making independent alarm decisions shall not be acceptable. Maximum total analog loop response time for detectors changing state shall be 0.5 seconds. Each detector shall have a separate means of displaying communication and alarm status. A green LED shall flash to confirm communication with the analog loop controller. A red LED shall flash to display alarm status. The detector shall be capable of identifying up to thirty-two (32) diagnostic codes. This information shall be available for system maintenance. The diagnostic code shall be stored at the detector. Each smoke detector shall be capable of transmitting pre-alarm and alarm signals in addition to the normal, trouble, and need cleaning information. It shall be possible to program control panel activity to each level. It shall be possible to individually program each smoke detector to operate at any one of five (5) sensitivity settings. Each detector microprocessor shall contain an environmental compensation algorithm, which shall identify and set ambient "environmental thresholds" approximately six (6) times an hour. The microprocessor shall continually monitor the environmental impact of temperature, humidity, other types of contaminates, as well as detector aging. The process shall employ digital compensation to adapt the detector to both twenty-four (24) hour long term and four (4) hour short term environmental changes. The microprocessor shall monitor the environmental compensation value and alert the system operator when the detector approaches eighty percent (80%) and one hundred percent (100%) of the allowable environmental compensation value. Differential sensing algorithms shall maintain a constant differential between

selected detector sensitivity and the “learned” base line sensitivity. The base line sensitivity information shall be updated and permanently stored at the detector approximately once every hour.

2.03 INTELLIGENT PHOTOELECTRIC TYPE SMOKE DETECTOR

A. This Contractor shall furnish and install intelligent photoelectric type smoke detectors as shown on the Drawings and herein specified. The analog photoelectric type smoke detector shall utilize a light scattering type photoelectric smoke sensor to sense changes in air samples from its surroundings, and shall operate between 0 degrees to 49 degrees celsius. The integral microprocessor shall dynamically examine values from the sensor and initiate an alarm based on the analysis of data. Systems using central intelligence for alarm decisions shall not be acceptable. The detector shall continually monitor any changes in sensitivity due to the environmental effects of dirt, smoke, temperature, aging, and humidity. The information shall be stored in the integral processor and transferred to the analog loop controller for retrieval using a laptop PC or similar program/service tool. The detector shall be rated for ceiling installation at a minimum of thirty (30) feet centers and shall be suitable for wall mount applications. The percent smoke obscuration per foot alarm set point shall be field selectable to any of five (5) sensitivity settings ranging from one percent (1%) to three and a half percent (3-1/2%). The photoelectric smoke detector shall be suitable for direct insertion into air ducts up to 3 ft (0.91m) high and 3 ft (0.91m) wide with air velocities up to 5,000 ft/min. (0-25.39 m/sec) without requiring specific duct detector housings or supply tubes. The detector shall be suitable for operation in the following environment:
   1. Temperature: thirty-two (32)˚F to one hundred twenty (120)˚F.
   2. Humidity: zero (0) to ninety-three percent (93%) relative humidity, non- condensing.
   3. Elevation: no limit.

B. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.

C. Where noted on the Drawings, intelligent photoelectric type smoke detectors shall be furnished and installed by this Contractor complete with wire guards.

D. Integral Visual-Indicating Light: LED type indicating detector has operated and power on status.

2.04 INTELLIGENT THERMAL DETECTOR

A. This Contractor shall furnish and install intelligent combination fixed temperature/rate-of-rise thermal detectors as shown on the Drawings and herein specified. The thermal detector shall have a low mass thermistor heat sensor and operate at a fixed temperature and at a temperature rate-of-rise. The detector shall continually monitor the temperature of the air in its’ surroundings to minimize thermal lag to the time required to process an alarm. The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of the data. Systems using central intelligence for alarm decisions shall not be acceptable. The intelligent thermal detector shall have a nominal fixed temperature alarm point rating of one hundred thirty-five (135)˚F and a rate-of-rise alarm point of fifteen (15)˚F per minute. The intelligent thermal detector shall be rated for ceiling installation at a minimum of seventy (70) foot centers and be suitable for wall mount applications.

2.05 INTELLIGENT CARBON MONOXIDE (CO) DETECTOR

A. This Contractor shall furnish and install intelligent carbon monoxide detectors with remote indicator as shown on the Drawings and herein specified. The carbon monoxide detectors detector shall have advanced electromechanical carbon monoxide sensing technology, ground fault detection, field replaceable carbon monoxide sensor/daughterboard module and automatic device mapping with electronic addressing. The intelligent carbon monoxide detectors shall have a operating temperature range of 32˚F To 120˚F. The intelligent carbon monoxide detectors shall be rated for both ceiling and wall mounted installation. Wall mounted detectors shall be mounted at a height recommended by the system manufacturer.

2.06 INTELLIGENT MONITOR MODULE

A. This Contractor shall furnish and install intelligent single input monitor modules as shown on the Drawings and herein specified. The intelligent single input monitor module shall provide one (1) supervised Class B input circuit capable of a minimum of four (4) personalities, each with a distinct operation. The module shall be suitable for mounting on a 1-1/2” deep four (4) inch square outlet box. The single input module shall support the following circuit types:

1. Normally-open alarm latching for manual pull stations, thermal detectors, etc.
2. Normally-open alarm delayed latching for sprinkler flow alarm switches.
3. Normally-open active non-latching for monitor, fans, dampers, door hold- open, etc.
4. Normally-open active latching for supervisory and sprinkler valve tamper switches.

B. It shall be possible to address each intelligent monitor module with the use of DIP or rotary switches. Modules using DIP switches for addressing shall be acceptable. The personality of multifunction modules shall be programmable at the site to suit conditions and shall be changeable at any time using a personality code downloaded from the analog loop controller. Modules requiring EPROM, PROM, or ROM changes shall not be acceptable. DIP switch and/or jumper changes shall be acceptable The module shall have a minimum of two (2) diagnostic LEDs mounted behind a finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to twenty-four (24) diagnostic codes that may be retrieved for troubleshooting assistance. Input and output circuit wiring shall be supervised for open and ground faults. The module shall be suitable for operation in the following environment:
   1. Temperature: thirty-two (32)˚F to one hundred twenty (120)˚F.
   2. Humidity: Zero (0) to ninety-three percent (93%) relative humidity, non- condensing.

C. An intelligent monitor modulecomplete with a cover plate designed to conceal the address setting means but allow the polling LED to show.

2.07 INTELLIGENT CONTROL MODULE

A. This Contractor shall furnish and install intelligent control relay modules as shown on the Drawings and herein specified. The intelligent control relay module shall provide one (1) form C dry relay contact rated at two (2) amps at 24 VDC to control external appliances or equipment shutdown. The control relay shall be rated for pilot duty and releasing systems. The position of the relay contact shall be confirmed by the system firmware. The module shall be suitable for mounting on a 1-1/2” deep four (4) inch square outlet box.

B. It shall be possible to address each intelligent monitor module with the use of DIP or rotary switches. Modules using DIP switches for addressing shall be acceptable. The personality of multifunction modules shall be programmable at the site to suit conditions and shall be changeable at any time using a personality code downloaded from the analog loop controller. Modules requiring EPROM, PROM, or ROM changes shall not be acceptable. Modules using DIP switch and/or jumper changes shall be acceptable. The module shall have a minimum of two (2) diagnostic LEDs mounted behind a finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to twenty-four (24) diagnostic codes that may be retrieved for troubleshooting assistance. Input and output circuit wiring shall be supervised for open and ground faults. The module shall be suitable for operation in the following environment:
   1. Temperature: thirty-two (32)˚F to one hundred twenty (120)˚F.
   2. Humidity: Zero (0) to ninety-three percent (93%) relative humidity, non- condensing.

C. An intelligent control module, which will meet this Specification, is EST Module No. SIGA-CR complete with a cover plate designed to conceal the address setting means but allow the polling LED to show.

2.08 INTERIOR MANUAL PULL STATIONS

A. This Contractor shall furnish and install double action, two stage, manual pull stations as shown on the Drawings and herein specified. The double action manual pull stations shall be addressable. Pull stations using DIP or rotary switches shall be acceptable. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The pull station shall include a locked test feature and an internal toggle switch. The red manual station shall be constructed of rugged aluminum or high impact Lexan. Stations shall be keyed alike with the control panel. The module shall be suitable for mounting on a 2-1/2” deep single gang outlet box or a 1-1/2” deep four (4) inch square outlet box with a single gang cover. The manual station shall be suitable for operation in the following environment:
   1. Temperature: thirty-two (32)˚F to one hundred twenty (120)˚F.
   2. Humidity: Zero (0) to ninety-three percent (93%) relative humidity, non- condensing.

B. Furnish and install Safety Technology International, Inc. (STI) clear lexan alarm covers Model No. 1100 (flush mounted) and/or 1130 (surface mounted) Stopper II.

2.09 AIR DUCT TYPE SMOKE DETECTORS

A. This Contractor shall furnish photoelectric duct smoke detectors as shown on the Drawings and herein specified. The duct smoke detector shall include a housing assembly to facilitate mounting an intelligent analog photoelectric detector along with a relay detector base. The detector housing shall be UL listed per UL 268A specifically for use in air handling systems. The detector shall operate at air velocities of 300 feet per minute to 4,000 feet per minute. An integral filter system shall be included to reduce dust and residual effects on the detector and housing. The duct detector shall include an air exhaust tube and an air sampling inlet tube that shall extend into the duct air stream up to ten (10) feet, a drilling template, and gaskets.

B. The detectors shall be furnished complete with auxiliary relay contacts to shut down the associated air handling unit upon activation of the duct detector.

C. The detectors shall be furnished complete with an intelligent monitor module.

D. Air duct type smoke detectors shall be furnished by this Contractor and installed in the air duct under DIVISION 15. Motor control wiring shall be furnished and installed under DIVISION 15. The detector shall be made part of the fire detection and alarm system by this Contractor.

E. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.

F. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
   1. Primary status.
   2. Device type.
   3. Present average value.
   4. Present sensitivity selected.
   5. Sensor range (normal, dirty, etc.).

G. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.

H. Where duct detectors are installed in area with a suspended ceiling, this contractor shall furnish and install a label on the ceiling grid below where the duct detector is installed.

I. This Contractor shall furnish and install a remote alarm indicator for each air duct type smoke detector. Each alarm indicator shall be complete with an engraved nameplate mounted adjacent to the indicator by this Contractor and lettered with the air handling unit number.

J. An air duct type smoke detector, which will meet this Specification, shall consist of the following.
   1. One (1) analog photoelectric type detector.
   2. One (1) sampling tube of the length required to suit the duct dimension.
   3. One (1) intelligent control module for shutdown of the air handling equipment.
   4. One (1) remote indicator.

2.10 SPRINKLER WATERFLOW SWITCHES

A. This Contractor shall furnish and install an intelligent monitor module for each waterflow switch installed.

2.11 VALVE TAMPER SWITCHES

A. This Contractor shall furnish and install an intelligent monitor module for each tamper switch installed.

2.12 WALL MOUNTED AUDIO/VISUAL ALARM SIGNALS

A. This Contractor shall furnish and install wall mounted electronic alarm signals as shown on the Drawings and herein specified. The alarm signals shall be of solid- state construction and shall produce a temporal horn sound output of 94.5 dBA avg. and 97.6 dBA peak at ten (10) feet. The strobes shall be selectable to produce a minimum of 15, 30, 75, 95, 110, 115, 150 and 177 candela effective intensity as shown on the drawings. The flash rate shall not exceed three (3) flashes per second nor be less than one (1) flash every three (3) seconds. This Contractor shall furnish and install wall mounting styles for surface, semi-

flush, or flush installation as shown on the Drawings. Alarm signals shall be complete with screw terminals for in-out field wiring of up to No. 12 AWG conductors and a red finish.

B. Audio/visual alarm signals shall be listed to: UL 1971; UL 1638; UL 464; ULC S525 and S526; ADA Chapter 28, Part 36 Final Rule; and NFPA 72, Chapter 7.

C. All audio/visual alarm signals shall be UL listed for fire protective service.

D. Audio/visual alarm signals shall be capable of operating from standard signaling circuits or from addressable intelligent signal modules.

E. Audio/visual alarm signals in areas noted on the Drawings shall be installed complete with wire guards furnished and installed by this Contractor.

F. The wall mounted audio/visual alarm signals, which meet this Specification, are Multi-candela Strobe field selectable at 15, 30, 75 or 110 Candela and Multi-candela Strobe field selectable at 95, 115, 150 or 177 Candela complete with red finish, mounting plate.

2.13 CEILING MOUNTED AUDIO/VISUAL ALARM SIGNALS

A. This Contractor shall furnish and install ceiling mounted electronic alarm signals as shown on the Drawings and herein specified. The alarm signals shall be of solid state construction and shall produce temporal horn sound output of 94.5 dBA avg. and 97.6 dBA peak at ten (10) feet. The strobes shall be selectable to produce a minimum of 15, 30, 75, 95, 115, 150 and 177 Candela. The flash rate shall not exceed three (3) flashes per second nor be less than one (1) flash every three (3) seconds. This Contractor shall furnish and install a mounting style for installation flush in the ceiling as shown on the Drawings. Alarm signals shall be complete with screw terminals for in-out field wiring of up to No. 12 AWG conductors and a white finish.

B. Audio/visual alarm signals shall be listed to: UL 1971; UL 1638; UL 464; ULC S525 and S526; ULC S525; ADA Chapter 28, Part 36 Final Rule; and NFPA 72, Chapter 7.

C. Audio/visual alarm signals shall be capable of operating from standard signaling circuits or from addressable intelligent signal modules.

D. The ceiling mounted audio/visual alarm signals, which will meet this Specification, are Multi-candela Strobe field selectable at 15, 30, 75 or 95 Candela, and Multi-candela Strobe field selectable at 95, 115, 150 or 177 Candela. Complete with white finish, mounting plate and ceiling orientated lettering.

2.14 WALL MOUNTED VISUAL ONLY ALARM SIGNALS

A. This Contractor shall furnish and install wall mounted electronic visual only alarm signals as shown on the Drawings and herein specified. The visual only alarm signal strobes shall be selectable to produce a minimum of 15, 30, 75, 95, 110, 115, 150 and 177 candela effective intensity as shown on the drawings. The flash rate shall not exceed three (3) flashes per second nor be less than one (1) flash every three (3) seconds. This Contractor shall furnish and install wall mounting styles for surface or semi-flush installation as shown on the Drawings. Visual only alarm signals shall be complete with screw terminals for in-out field wiring of up to No. 12 AWG conductors and a red finish.

B. Visual only alarm signals shall be listed to: UL 1971; UL 1638; ULC S525 and S526; ADA Chapter 28, Part 36 Final Rule; and NFPA 72, Chapter 7.

C. Visual only alarm signals shall be capable of operating from standard signaling circuits or from addressable intelligent control modules.

D. Visual only alarm signal noted on the Drawings shall be complete with wire guards furnished and installed by this Contractor.

E. The wall mounted visual alarm signals, which will meet this Specification, are Multi-candela Strobe field selectable at 15, 30, 75 or 110 and Multi-candela Strobe field selectable at 95, 115, 150 or 177 candela complete with red finish, mounting plate.

2.15 CEILING MOUNTED VISUAL ONLY ALARM SIGNALS

A. This Contractor shall furnish and install ceiling mounted electronic visual only alarm signals as shown on the Drawings and herein specified. The visual only alarm signals strobes shall be selectable to produce a minimum of 15, 30, 75, 95, 115, 150 and 177 Candela effective intensity as shown on the drawings. The flash rate shall not exceed three (3) flashes per second nor be less than one (1) flash every three (3)

seconds. This Contractor shall furnish and install a ceiling mounting style for flush installation as shown on the Drawings. Visual only alarm signals shall be complete with screw terminals for in-out field wiring of up to No. 12 AWG conductors and a white finish.

B. Visual only alarm signals shall be listed to: UL 1971; UL 1638; ULC S525 and S526; ADA Chapter 28, Part 36 Final Rule; and NFPA 72, Chapter 7.

C. Visual only alarm signals shall be capable of operating from standard signaling circuits or from addressable intelligent control modules.

D. The ceiling mounted visual only alarm signals, which will meet this Specification, is Multi-candela ceiling strobe field selectable at 15, 30, 75 or 95 Candela and Multi-candela Strobe field selectable at 95, 115, 150 or 177 Candela complete with white finish, mounting plate, and ceiling orientated lettering.

2.16 EXTERIOR ALARM SIGNALS

A. This Contractor shall furnish and install exterior alarm signals as shown on the Drawings and herein specified. The exterior alarm signals shall be of solid state construction and shall produce a temporal horn sound output of 92 dBA peak at ten (10) feet. Maximum current shall be 0.023 Amps at 24 VDC. Exterior alarm signals shall be complete with screw terminals for in-out field wiring of up to No. 12 AWG conductors and a red finish.

B. Exterior alarm signals shall be listed to: UL 1971; UL 1638; UL 464; ULC S525 and S526; ADA Chapter 28, Part 36 Final Rule; and NFPA 72, Chapter 7.

C. All exterior alarm signals shall be UL listed for fire protective service.

D. Exterior alarm signals shall be capable of operating from standard signaling circuits or from addressable intelligent signal modules.

E. Exterior alarm signals shall be suitable for installation of the exterior of the building, bear the appropriate UL label, and shall be furnished complete with a surface mounted weatherproof outlet box.

F. An exterior alarm signal that will meet this Specification is complete with red finish, mounting plate, and red finished surface mounted weatherproof outlet box.

2.17 EXTERIOR AUDIO/VISUAL ALARM SIGNALS

A. This Contractor shall furnish and install exterior audio/visual alarm signals as shown on the Drawings and herein specified. The exterior alarm signals shall be of solid state construction and shall produce a temporal horn sound output of 92 dBA peak at ten (10) feet. The strobes shall be minimum of 75 and 110 Candela. The flash rate shall not exceed three (3) flashes per second nor be less than one (1) flash every three (3) seconds. This Contractor shall furnish and install wall mounting styles for surface or semi-flush installation as shown on the Drawings. Audio/Visual alarm signals shall be complete with screw terminals for in-out field wiring of up to No. 12 AWG conductors and a red finish.

B. Exterior audio/visual alarm signals shall be listed to: UL 1971; UL 1638; UL 464; ULC S525 and S526; ADA Chapter 28, Part 36 Final Rule; and NFPA 72, Chapter 7.

C. All exterior audio/visual alarm signals shall be UL listed for fire protective service.

D. Exterior audio/visual alarm signals shall be capable of operating from standard signaling circuits or from addressable intelligent signal modules.

E. Exterior audio/visual alarm signals shall be suitable for installation of the exterior of the building, bear the appropriate UL label, and shall be furnished complete with a surface mounted weatherproof outlet box.

F. An exterior audio/visual alarm signals that will meet this Specification is (75cd) and/or (110cd) complete with white finish, mounting plate, and red finished surface mounted weatherproof outlet box.

2.18 REMOTE GRAPHIC ANNUNCIATOR PANEL

A. This Contractor shall furnish and install where shown on the Drawings, a remote graphic annunciator panel. The annunciator panel shall have white photo- emulsion graphics as detailed on the Drawings. The graphics shall be applied to a smoked Plexiglas panel to assure legibility and ease of future on-site updating. The graphics panel shall be protected by a outer layer of non-glare Plexiglas. All electrical connections shall be made to screw terminals mounted on a back plate that shall connect to the faceplate with ribbon cables. The LED system, positioned behind the graphic panel shall be visible only in the ON

mode. The panel shall be framed in architectural gray aluminum and mounted by this Contractor in a flush steel backbox. A key lock and hidden-screw construction shall be provided for tamper resistance. The annunciator panel shall be keyed alike for all the control switches but different from the annunciator panel door access key.

B. Display Type and Functional Performance: Graphic. Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset.

C. The annunciator shall operate via a data line connected to the main control panel. Annunciators that require a separate conductor for each indicator shall not be acceptable.

2.19 **MAGNETIC DOOR HOLDERS**

A. Magnetic door holders shall be furnished and installed by this Contractor as required for the mounting conditions and controlled by the fire alarm and detection system. This Contractor shall coordinate with the hardware supplier and the door installer to assure proper alignment, preparation, and operation with the associated doors. The door mounted magnets shall be mounted with bolts through the door with finish grade back plates. Magnets shall be 24VDC and shall be mounted as indicated on the Drawings.

B. This Contractor shall furnish and install an intelligent control module for each set, or adjacent sets, of magnetic door holders as shown on the Drawings.

2.20 **FIELD WIRING**

A. Field wiring for each intelligent loop shall consist of cables furnished and installed by this Contractor. The type, size, and number of conductors in the cable shall be in strict compliance with the manufacturer's requirements.

B. Field wiring for all alarm signals shall consist of cables furnished and installed by this Contractor. The type, size, and number of conductors in the cable shall be in strict compliance with the manufacturer's requirements.

C. Magnetic door holder power wiring from the main control panel shall consist of two (2) conductor, No. 12 AWG, furnished and installed by this Contractor.

D. All field wiring below ceilings or in rooms without ceilings shall be in minimum 1/2" conduit.

PART 3 - EXECUTION

3.01 **EQUIPMENT INSTALLATION**

A. Comply with NFPA 70, NFPA 72 and IBC for installation of fire-alarm equipment.

B. Equipment Mounting: Install fire-alarm control unit on finished floor with tops of cabinets not more than 72 inches above the finished floor.

C. Install wall-mounted equipment, with tops of cabinets not more than 72 inches above the finished floor

3.02 **FIRE ALARM CONTROL EQUIPMENT**

A. All fire alarm control equipment, including the main control panel and any signal extender panels shall be supplied from the building's 120 volt EMERGENCY power source. Contractor shall be responsible for providing any additional devices required by code or these specifications for any control equipment located other than in the Communications Room, including 120 volt EMERGENCY power. These other locations must be specifically approved by the Owner.

3.03 **MAIN CONTROL PANEL**

A. The main control panel backbox(s) shall be mounted on the wall, and all interior components furnished and installed by this Contractor, at the location shown on the Drawings in accordance with manufacturer's recommendations. Mounting height shall be approximately sixty (60) inches above the finished floor to the center of cabinet, with tops of cabinets not more than 72 inches above the finished floor.

3.04 **MANUAL STATIONS**

A. Manual stations shown on the Drawings to be installed on existing walls or partitions shall be furnished and installed in surface device boxes of the appropriate size and shall be suitable for use with surface metal raceway. Existing conduits concealed in masonry walls may be reused only with the written approval of the Owner.

B. Manual stations shown on the Drawings to be installed in new construction shall be furnished and installed by this Contractor to flush device boxes of the appropriate size as recommended by the equipment manufacturer.

C. Wire guards to be installed over manual stations shall be furnished and installed by this Contractor. Wire guards shall not be anchored into acoustical wall panels. This Contractor shall insure that wood blocking is installed behind the wall panels. The wire guards shall be anchored through the wall panels and into the wood blocking.

3.05 **SMOKE DETECTORS**

A. Smoke detectors shown on the Drawings to be installed in areas with suspended ceilings shall be surface mounted as high as possible on ceiling with concealed outlet boxes supported from structure.

B. Smoke detectors shown on the Drawings to be installed in areas without suspended ceilings shall be mounted to a surface mounted outlet box rigidly attached to the building structure independently of the associated conduits.

C. Smoke detectors required for smoke damper control shall be furnished and installed by this contractor. Coordinate locations with Mechanical drawings.

D. All smoke detectors shall be thoroughly cleaned at the end of the project prior to the system being turned over to the Owner.

E. Smoke- or Heat-Detector Spacing:
   1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
   2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
   3. HVAC: Locate detectors not closer than 5 feet from air-supply diffuser or return-air opening.
   4. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture.

3.06 **THERMAL DETECTORS**

A. Thermal detectors shown on the Drawings to be installed in areas with suspended ceilings shall be surface mounted on the ceiling with concealed outlet boxes.

B. Thermal detectors shown on the Drawings to be installed in areas without suspended ceilings shall be mounted as high as possible to surface mounted outlet boxes rigidly attached to the building structure independently of the associated conduits.

3.07 **INTELLIGENT CARBON MONOXIDE (CO) DETECTOR**

A. Intelligent carbon monoxide detectors shown on the Drawings to be installed in areas with suspended ceilings shall be surface mounted as high as possible on ceiling with concealed outlet boxes supported from structure.

B. Intelligent carbon monoxide detectors shown on the Drawings to be installed in areas without suspended ceilings shall be mounted to a surface mounted outlet box rigidly attached to the building structure independently of the associated conduits.

C. All intelligent carbon monoxide detectors shall be thoroughly cleaned at the end of the project prior to the system being turned over to the Owner.

3.08 **INTELLIGENT CONTROL, MONITOR, AND SIGNAL MODULES**

A. Intelligent control, monitor, and signal modules shall be flush mounted in the ceiling as close as possible to the associated device. In areas without ceilings, the modules may be mounted to the underside of the structure, or wall mounted. Wherever possible, the modules shall be ganged together.

B. Intelligent control and monitor modules for sprinkler flow and tamper switches and the fire pump shall be flush mounted in the front face of a wiring trough as detailed on the Drawings.

3.09 **REMOTE GRAPHIC ANNUNCIATOR PANEL**

A. The remote graphic annunciator panel backbox shall be mounted and all interior components furnished and installed by this Contractor, at the location shown on the Drawings in accordance with manufacturer's

recommendations. Mounting height shall be approximately fifty two (52) inches above finished floor to the center of cabinet, and top of panel not more than 72”.

3.10 **SPRINKLER FLOW ALARM SWITCHES**

A. This Contractor shall make all electrical connections necessary to properly integrate these devices into the fire detection and alarm system.

3.11 **SPRINKLER VALVE TAMPER SWITCHES**

A. This Contractor shall make all electrical connections necessary to properly integrate these devices into the fire detection and alarm system.

3.12 **ALARM SIGNALS**

A. Audio/visual and visual only alarm signals shown on the Drawings to be installed on existing walls or partitions shall be furnished and installed by this Contractor over surface device boxes of appropriate size and suitable for use with surface metal raceways.

B. Audio/visual and visual only alarm signals shown on the Drawings to be installed in new construction shall be furnished and installed by this Contractor over concealed device boxes of appropriate size with the appropriate trim rings.

C. Audio/visual and visual only alarm signals shown on the Drawings to be installed flush and/or semi-flush mounted in ceilings shall be installed by this Contractor over concealed flush mounted device boxes of appropriate size with the appropriate trim rings. The box shall be supported by ceiling support bridges and steel wire directly to building structure.

D. Audio/Visual and Visual only alarm signals shown on the Drawings to be ceiling mounted in areas with open structure (no suspended ceiling) shall be furnished by this contractor over surface device boxes of the appropriate size and suitable for use with surface conduit. The boxes shall be mounted directly to the underside of the structural members or metal framing channels bridging the structural members.

3.13 **AIR DUCT TYPE SMOKE DETECTORS**

A. Air duct type smoke detectors shall be furnished under this DIVISION and mounted into ducts and connected to the air handler control circuit. This Contractor shall perform all wiring connections to the fire detection and alarm system and complete system test.

B. Air duct type smoke detectors shall be thoroughly cleaned at the end of the project prior to the system being turned over to the Owner.

C. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.

3.14 **FIELD WIRING**

A. All line and low voltage wiring, conduit, backboxes, device mounting boxes, and junction boxes required for the fire detection and alarm system shall be furnished and installed by this Contractor.

B. All low voltage field wiring shall be installed, by this Contractor.

C. This Contractor shall make all connections to panels, devices, and detectors with crimp type spade terminal connectors. Splices in station circuits shall be made only in junction boxes.

D. All wiring shall be checked and tested by this Contractor to insure the system is free from grounds, opens, and shorts.

E. The installation and final connections of all components and devices shall be performed under the direct supervision of the system manufacturer's technical staff.

3.15 **GROUNDING**

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.16 **FIELD PROGRAMMING**

A. The manufacturer's technical representative shall field program the fire detection and alarm system after all related equipment has been installed and prior to any final testing. The technical representative shall

be factory certified for programming. The initial program shall be developed by the equipment supplier in conjunction with the Owner and Fire Marshal.

B. In addition to the initial field programming described above, the contractor shall furnish an additional two (2) sessions of field programming changes to be performed at any time during the warranty period at no additional expense to the Owner.

3.17 **ON-SITE AS-BUILT DRAWINGS**

A. The Contractor shall provide one (1) set of the fire alarm system supplier's as- built drawings for permanent use on-site. The contractor shall supply and mount a document box to be located near the fire alarm control panel.

END OF SECTION

SECTION 31 0916.21
PILE LOAD TESTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pile load testing and documenting results.

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Testing laboratory services.

B. Section 31 6213.19 - Precast Concrete Piles.

C. Section 31 6216.16 - Steel H Piles.

D. Section 31 6219 - Timber Piles.

E. Section 31 6223.13 - Concrete-Filled Steel Piles.

F. Section 31 6329 - Drilled Concrete Piers and Shafts.

1.03 REFERENCE STANDARDS

A. ASTM D1143/D1143M - Standard Test Method for Deep Foundations Under Static Axial Compressive Load 2007 (Reapproved 2013).

B. ASTM D3689/D3689M - Standard Test Method for Deep Foundations Under Static Axial Tensile Load 2007, with Editorial Revision (2013).

C. ASTM D3966/D3966M - Standard Test Method for Deep Foundations Under Lateral Loads 2007 (Reapproved 2013).

D. ASTM D4945 - Standard Test Method for High-Strain Dynamic Testing of Deep Foundations 2012.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate test method and equipment, load type, calibration equipment.

C. Designer Qualification Statement.

1.05 QUALITY ASSURANCE

A. Monitor test pile placement and elevations under direct supervision of a Professional Engineer experienced in design of this work and licensed in Maryland.

B. Maintain one copy of each test method document on site.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Provide equipment, load carrying devices, loads, and instrumentation as required by test methods specified in PART 3.

B. Test Crib: Provide one test crib for pile load testing.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify site conditions will support cribbing and load for testing purposes.

3.02 PREPARATION

A. Establish stable working elevation for test equipment.

3.03 TESTING

A. Perform load tests for piles specified in the following Sections:
   1. Section 31 6213.19 - Precast Concrete Piles.
   2. Section 31 6216.16 - Steel H Piles.
   3. Section 31 6219 - Timber Piles.
   4. Section 31 6223.13 - Concrete-Filled Steel Piles.
   5. Section 31 6329 - Drilled Concrete Piers and Shafts.

B. Load test the following:
   1. 6 indicator piles at locations as directed.
   2. One pile in first 100 piles.
   3. One pile in next 250 piles.
   4. One pile in each 500 piles thereafter.

C. Perform the following tests on each test pile:
   1. High-strain impact test as specified in ASTM D4945.
   2. Static axial compression load test as specified in ASTM D1143/D1143M.
   3. Static axial tensile load test as specified in ASTM D3689/D3689M.
   4. Lateral load test as specified in ASTM D3966/D3966M.
   5. Subject piles to 1-3/4 times design load.

D. Acceptable Permanent Set of Piles After Load Testing: 1/8 inch (3 mm).

E. If tested piles do not conform to requirements, perform additional testing of other piles.

3.04 FIELD QUALITY CONTROL

A. Field inspection and monitoring of testing will be performed under provisions of Section 01 4000.

B. An independent inspection firm will be engaged to observe and document test method and results.

C. Document test equipment used, method of calibration and recording, test results, recommendations or modification of piling method used.

D. Accurately record actual dimensions and locations of tested piles and movement or distortion caused by testing.

3.05 EQUIPMENT REMOVAL

A. Remove test and temporary load equipment from site.

END OF SECTION

SECTION 31 1000
SITE CLEARING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Clearing and protection of vegetation.

B. Removal of existing debris.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Limitations on Contractor 's use of site and premises.

B. Section 01 1000 - Summary: Sequencing and staging requirements.

C. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

D. Section 01 5713 - Temporary Erosion and Sediment Control.

E. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products.

F. Section 01 7419 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

G. Section 02 4100 - Demolition: Removal of built elements and utilities.

H. Section 31 2200 - Grading: Topsoil removal.

I. Section 31 2200 - Grading: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

J. Section 31 2323 - Fill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

K. Section 32 9300 - Plants: Relocation of existing trees, shrubs, and other plants.

L. Section 32 9300 - Plants: Pruning of existing trees to remain.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Site Plan: Showing:

1. Vegetation removal limits.
2. Areas for temporary construction and field offices.

1.04 QUALITY ASSURANCE

A. Clearing Firm: Company specializing in the type of work required.

B. Conform to applicable codes and local, state and federal regulations for disposal of debris and use of herbicides. Burning of debris, lumber or scrap will not be permitted.

C. Coordinate clearing work with the Project Manager.

D. Obtain the owner's approval prior to removal of tree branches. Removal of tree branches shall be under the supervision of the owner.

1.05 PROJECT CONDITIONS

A. Traffic: Conduct site-clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks, or other occupied or

used facilities without permission from authorities having jurisdiction.

B. Protection of Existing Improvements: Provide protections necessary to prevent damage to existing improvements indicated to remain in place.

PART 2 PRODUCTS -- NOT USED

1. Protect improvements on adjoining properties and on Owner’s property.
2. Restore damaged improvements to their original condition, as acceptable to property owners, in a timely manner and at no additional cost to the Owner.

B. Soil Erosion and Sediment Control: Soil erosion and sediment control measures are required for this site in accordance with the approved plans. Soil erosion and sediment control measures disturbed or damaged by clearing operations shall be restored to operating condition in accordance with the requirements of the approved plan before the end of the work day.

C. Protection of Existing Trees and Vegetation: Protect existing trees and other vegetation indicated to remain in place against unnecessary cutting, breaking or skinning of roots, skinning or bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary guards to protect trees and vegetation to be left standing.

1. Water trees and other vegetation to remain within limits of contract work as required to maintain their health during course of construction operations.
2. Provide protection for roots over 1-1/2 inch in diameter that are cut during construction operations. Coat cut faces with an emulsified asphalt or other acceptable coating formulated to use on damaged plant tissues. Temporarily cover exposed roots with wet burlap to prevent roots from drying out, cover with earth as soon as possible.
3. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations in manner acceptable to Architect. Employ a licensed arborist to repair damage to trees and shrubs.
4. Replace trees that cannot be replaced and restored to full-growth status, as determined by arborist. E. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner’s premises where indicated or directed.

PART 3 EXECUTION

3.01 SITE CLEARING

A. Comply with other requirements specified in Section 01 7000.

B. Minimize production of dust due to clearing operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

3.02 EXISTING UTILITIES AND BUILT ELEMENTS

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Protect existing structures and other elements that are not to be removed.

3.03 VEGETATION

A. Scope: Remove trees, shrubs, brush, and stumps in areas to be covered by building structure, paving, playing fields, lawns, and planting beds.

B. Do not begin clearing until vegetation to be relocated has been removed.

C. Do not remove or damage vegetation beyond the limits indicated on drawings.

1. 40 feet (12 m) outside the building perimeter.
2. 10 feet (3.1 m) each side of surface walkways, patios, surface parking, and utility lines less than 12 inches (305 mm) in diameter.
3. 15 feet (4.6 m) each side of roadway curbs and main utility trenches.
4. 25 feet (7.5 m) outside perimeter of pervious paving areas that must not be compacted by construction traffic.
5. Exception: Specific trees and vegetation indicated on drawings to be removed.
6. Exception: Selective thinning of undergrowth specified elsewhere.

D. Install substantial, highly visible fences at least 3 feet high (at least 1 m high) to prevent inadvertent damage to vegetation to remain:

1. At vegetation removal limits.
2. Around trees to remain within vegetation removal limits; locate no closer to tree than at the drip line.
3. Around other vegetation to remain within vegetation removal limits.
4. See Section 01 5000 for fence construction requirements.

E. In areas where vegetation must be removed but no construction will occur other than pervious paving, remove vegetation with minimum disturbance of the subsoil.

F. Vegetation Removed: Do not burn, bury, landfill, or leave on site, except as indicated.

1. Chip, grind, crush, or shred vegetation for mulching, composting, or other purposes; preference should be given to on-site uses.
2. Trees: Sell if marketable; if not, treat as specified for other vegetation removed; remove stumps and roots to depth of 18 inches (450 mm).
3. Existing Stumps: Treat as specified for other vegetation removed; remove stumps and roots to depth of 18 inches (450 mm).
4. Sod: Re-use on site if possible; otherwise sell if marketable, and if not, treat as specified for other vegetation removed.
5. Fill holes left by removal of stumps and roots, using suitable fill material, with top surface neat in appearance and smooth enough not to constitute a hazard to pedestrians.

G. Dead Wood: Remove all dead trees (standing or down), limbs, and dry brush on entire site; treat as specified for vegetation removed.

H. Restoration: If vegetation outside removal limits or within specified protective fences is damaged or destroyed due to subsequent construction operations, replace at no cost to Owner.

3.04 DEBRIS

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

3.05 DISPOSAL OF WASTE MATERIALS

A. Burning on Owner’s Property: Burning is not permitted on Owner’s property.

END OF SECTION

A. Removal from Owner’s Property: Remove waste materials and unsuitable topsoil from Owner’s property and dispose of off-site in accordance with local regulations.

4.02 RECORD DRAWINGS

A. Survey and include on record drawings location and depth of all utilities encountered which have not been removed.

SECTION 31 1005
SITE DEMOLITION

PART 1 - GENERAL:

1.01 RELATED DOCUMENTS:

A. The General Conditions, Supplementary Conditions and Division 1, General Requirements, are a part of this section.

1.02 RELATED WORK:

A. Refer to Section 31 20 00 "Earthmoving", and Division 26 "Electrical".

1.03 DESCRIPTION OF WORK:

A. This section specifies demolition of existing site improvements and underground utilities.

1.04 CODES:

A. For existing utilities refer to Section 31 20 00 "Earthmoving".

1.05 PROJECT CONDITIONS:

A. Refer to Section 31 20 00 "Earthmoving" and as noted.

B. Existing Utilities: The locations of all existing utilities are approximate. These locations have been determined from field survey, public utility records and Owner records.

1. The Contractor shall be responsible for contacting "Miss Utility" and all Owner's or controlling agencies of existing utilities within the construction area for verification of locations, prior to beginning of work.

2. The Contractor shall be responsible for coordination of utility relocation or removal by others with all phases of construction activities.

C. Existing Subsurface Conditions: Verify existing pavement materials and respective thicknesses during prebid inspection. Obtain written authorization from the owner before conducting test hole explorations of existing pavements within the project site.

D. Traffic: Obtain written authorization from the local jurisdiction or adjacent property owners prior to obstructing vehicular traffic and parking areas. Obtain written authorization from local jurisdiction prior to obstructing public rights-of-way and easements.

E. Pre-bid Inspection Conditions: Conditions, existing during prebid inspections, will not be altered or modified.

F. All work must be contained within the prescribed limits of disturbance shown on the contract documents.

1.06 SUBMITTALS:

A. Submit written notifications to public utility companies for disconnection of active utilities.

1.07 DEFINITIONS:

A. Demolition: Complete removal and disposal of existing facilities specified or indicated, "Remove".

B. Salvage: Complete removal, by methods, which prevent damage or destruction of any items indicated to be relocated (or salvaged) and subsequent relocation and reinstallation in an area designated by Owner.

PART 2 - PRODUCTS: (NOT USED) PART 3 - EXECUTION:

2.01 PROTECTION AND RESTORATION:

A. Refer to Section 31 10 00 "Clearing" and Section 31 20 00 "Earthmoving”.

B. Existing Facilities: Protect existing facilities and structures designated to remain, temporarily or permanently, from damage during demolition or construction activities. Repair items damaged during demolition or construction activities to their original condition, or replace with new. Do not overload structural elements or pavements to remain. Provide new supports and reinforcement for existing construction weakened by demolition and/or removal work. Repairs, reinforcement or structural replacement shall be approved by the Architect or the Owner's Representative.

C. Weather Protection: For portions of the existing building to remain, protect building interior and materials and equipment from the weather at all times. Where removal of roofing or walls is necessary to accomplish work, immediately provide adequate temporary covering of exposed areas to assure protection of remaining facilities.

D. Existing Utility Services: The locations of underground utility services are approximate, and are taken from Owner's record information and record information provided by utility companies. Protect existing utility services designated to remain temporarily or perma- nently, or to be relocated or removed by others. Contractor shall sequence demolition and construction activities to minimize utility service interruptions to existing facilities to re- main. Where removal of existing utility services is required for other site construction, provide temporary covering of exposed areas, and temporary service or connections for utilities until permanent utility service replacements are completed.

1. Contractor shall coordinate with affected utility companies to determine extent of relocation work to be done by others.

2. Contractor shall coordinate utility relocation or removal by others with all phases of construction activity.

2.02 EXISTING SITE IMPROVEMENTS DEMOLITION:

A. Existing Pavements: Demolish existing pavements, regardless of pavement thickness, to limits indicated at no increase to contract sum. Neatly saw cut existing bituminous concrete pavement to straight, smooth and sharp edges perpendicular to pavement surface.

B. Existing Curbing: Demolish existing curbing to limits indicated, unless nearest expansion joint is less than six (6) feet from the indicated limits of removal. In that case, remove existing concrete curbing to the nearest expansion joint beyond the indicated demolition limits at no increase to the Contract Sum. Neatly saw cut existing portland cement concrete curbing, to limits indicated, to smooth, clean and sharp edges perpendicular to top and face of curbing.

1. Contractor's Option: Remove existing concrete curbing to nearest expansion joint beyond demolition limits indicated at no increase to contract sum.

C. Existing Entrances and Aprons: Demolish existing entrances and aprons indicated.

D. Miscellaneous: Demolish existing fencing indicated, including posts, footings and related appurtenances. Demolish additional miscellaneous existing site improvements indicated, specified and required to construct project.

2.03 EXISTING OVERHEAD UTILITY DEMOLITION:

A. Existing electrical facilities will be removed by Potomac Electric and Power Company. Contractor shall contact PEPCO to schedule and arrange for payment for removals.

B. Existing telephone facilities will be removed by Telephone Company. Contractor shall contact Telephone Company to schedule and arrange for payment for removals.

C. Existing cable television facilities will be removed by Comcast Cable Company. Contractor shall contact Comcast to schedule and arrange for payment for removals.

2.04 EXISTING UNDERGROUND UTILITY DEMOLITION:

A. Excavate and expose existing underground utilities and related structures designated for, or as required to implement, removals. For excavation operations refer to Section 33 10 00 "Utility Standards". Remove existing utility structure castings. Backfill excavations, upon completion of utility demolition operations. For backfill operations refer to Section 33 10 00 "Utility Standards".

2.05 MAINTENANCE:

A. Refer to Section 31 20 00 "Earthmoving".

2.06 SALVAGE MATERIALS:

A. Carefully remove items designated for Salvage, or "Remove and Relocate", to avoid damage. Store site items indicated for salvage, or "Remove and Relocate", to prevent damage during construction. Relocate items as indicated on site plan or as directed in the field by the Owner's Representative. Contractor shall replace salvage items damaged during removal, storage or relocation operations at no increase to the Contract sum.

2.07 WASTE MANAGEMENT:

A. Transport demolition waste materials from the project site to legal offsite waste disposal areas. Document legal offsite waste disposal areas.

B. Recycle waste demolition materials in accordance with Division 1 “Construction Waste Management” requirements.

END OF SECTION

SECTION 31 2000
EARTHMOVING

PART 1 - GENERAL:

1.01 RELATED DRAWINGS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 1, Specification Sections, apply to work in this section.

1.02 DESCRIPTION OF WORK:

A. This section specifies materials, equipment and work required to perform earthwork and grading operations for site development.

1.03 TESTING AND INSPECTIONS:

A. The Owner shall be responsible for providing a Maryland Registered Professional Soils Engineer for required testing and inspections.

B. Services of the Soils Engineer will not necessarily be on a full time basis, but will include the number of visits and tests required to observe the performance of all earthwork under this Section. If in the opinion of the Soils Engineer, any work performed under this Section does not meet the technical or design requirements stipulated for the work, the Contractor shall make all necessary readjustments to his approval.

C. All earthwork procedures shall be performed in the presence of the Soils Engineer. Give adequate (24 hours) notice when Soils Engineer’s services are required.

1.04 RELATED WORK:

A. Refer to Section 31 10 00 "Clearing", Section 31 10 05 "Demolition"

1.05 CODES:

A. Contractor shall comply with the applicable requirements of the governing agencies having jurisdiction.

B. In performance of the Work the Contractor will, at a minimum, satisfy all federal, state and local statutes, regulations and ordinances, regarding training as well as health and safety, including medical record retention as required. The Contractor is responsible for any required OSHA compliance monitoring for workers potentially exposed to concentrations of contaminants above the OSHA permissible exposure limits.

C. The Contractor has the responsibility to develop and provide its employees and Subcontractors with a Health and Safety Plan (HASP) prior to commencement of their work on the site. This HASP shall include measures for working with contaminated soil. Precautions shall be exercised by the Contractor and its Subcontractors at all times for the protection of persons (including employees) and property. The safety provisions of applicable laws and of building and construction codes shall be observed. The safety of the Contractor's employees and Subcontractors shall be the Contractor's responsibility.

1.06 DEFINITIONS:

A. Excavation: Removal of earth materials to subgrade elevations indicated or specified.

B. Over-Excavation: Removal of earth materials, beyond subgrade elevations indicated or specified, without written authorization from the Architect.

C. Unsuitable Earth: Soft or unstable earth materials beyond limits of excavation indicated (e.g. muck, soft clays, organic soils, peat, etc.).

D. Fill: Placement of earth materials over existing ground surfaces to subgrade elevations indicated or specified.

E. Backfill: Placement of earth materials in excavations to subgrade elevations indicated or specified.

F. Soils Engineer: Shall be a Professional Engineer, currently registered in the State of Mary- land, or shall be an authorized representative of such an engineer.

G. Rock Excavation: Rock excavation includes removal and disposal of rock materials and obstructions encountered that cannot be removed by the following heavy-duty excavation equipment without systematic drilling, blasting, or ripping:

1. Bulk Excavation: Caterpillar Model No. D-8 (or equivalent machinery), heavy duty, track-mounted loader/dozer; rated at not less than 285-hp flywheel power with a single- shank hydraulic ripper, capable of exerting a minimum of 45,000-lbf breakout force; measured according to SAE J-1179.

a. Excavations more than 10 feet wide and 30 feet in length or width are defined as open excavations.

2. Excavation of Footings, Trenches, and Pits: Caterpillar Model no. 215D LC (or equiva- lent machinery), track-mounted hydraulic excavator; equipped with a 42-inch wide, short-tip-radius rock bucket; rated at not less than 120-hp flywheel power with bucket- curling force of not less than 25,000 lbf and stick-crowd force of not less than 18,000 lbf with extra-long reach boom; measured according to SAE J-1179.

3. Rock removal includes boulders 3/4 cubic yard or more in volume and rock in beds, ledges, unstratified masses, and conglomerate deposits.

1.07 SUBMITTALS:

A. Density Test Results: The Contractor shall submit copies of the results of the specified density testing to the Owner's Representative for review and approval.

B. Submit location of product manufacture and of extraction/recovery of primary raw materials.

C. Submit recycled-content data, designating percentages of post-consumer and post-industrial recycled material.

1.08 PROJECT CONDITIONS:

A. Existing Subsurface Conditions: A subsurface investigation has been conducted at the project site to determine general subsurface conditions. Additional subsurface investigations may be made by the Contractor at no increase to the contract sum. Obtain written authorization from the Owner before proceeding with subsurface investigations.

B. Existing Utilities: The locations of all existing utilities are approximate. These locations have been determined from field survey, public utility records and Owner records.

1. The Contractor shall be responsible for contacting "Miss Utility" and all Owner's or controlling agencies of existing utilities within the construction area for verification of locations, prior to beginning of work.

2. The Contractor shall be responsible for coordination of utility relocation or removal by others with all phases of construction activities.

C. The Contractor should assume a portion of the contaminated soil will require offsite disposal and a portion of the contaminated soil can be reused onsite as subsurface fill material. The Contractor should assume that the areas of contaminated soil excavation will not exceed 4 feet in depth and the excavations will not encroach upon roadways or structures or encounter subsurface structures or utilities. The Contractor should assume that multiple areas of con- taminated soil excavation are located onsite. Additionally, the contractor should assume that the contaminated soil intended for reuse onsite will be placed in multiple areas onsite.

1.09 CONSTRUCTION SURVEYS:

A. Provide survey equipment and qualified personnel for construction surveys. Provide combined vertical and horizontal stakes required to perform earthwork operations to subgrade elevations indicated or specified.

1.10 EARTHWORK BALANCE:

A. Perform all earthwork operations regardless of actual quantities encountered.

1. Excess materials shall be legally disposed of off project property.
2. Off-site borrow shall be provided at no increase to the Contract sum.

1.11 QUALITY ASSURANCE

A. An independent testing laboratory, selected and paid for by the Contractor, will be retained to perform construction testing on site.

PART 2 - PRODUCTS:

1. The independent testing laboratory shall prepare test reports that indicate test location, elevation data, and test results. Owner, Civil Engineering Consultant, and Contractor shall be provided with copies of reports within 96 hours of time that test was performed. In event that test performed fails to meet Specifications, the independent testing laboratory shall notify Owner and Contractor immediately.
2. Cost related to retesting due to failures shall be paid for by the Contractor at no additional expense to Owner. Contractor shall provide free access to site for testing activities.
3. Quality assurance testing will be conducted in accordance with Paragraph “Field Testing” in Part 3 hereinafter.

2.02 MATERIALS:

A. Provide products manufactured and of primary raw materials extracted/recovered within a 500-mile radius of the project site.

B. Fill Materials: Soils used as fill materials shall have Unified Soils Classification (ASTM D 2487) of SM, SC or more granular. Soil material for fill shall be free of organic matter or debris, waste materials, frozen materials, vegetable matter and rock or stones exceed- ing three inches in any dimension. No more than 15 percent of rocks or lumps shall be larger than 2½ inches in any dimension. Materials shall be non-frost susceptible soils, and shall have a liquid limit of less than 40 and a plasticity index of less than 20. RC-6 recycled concrete shall be used as fill and subbase material, except under building slab, as performance requirements permit.

1. Fill material used within the top 12 inches of fill shall be free of rocks or stones exceeding two inches in any dimension.

C. Backfill Material: As indicated for fill material.

D. Borrow Material: Off-site borrow, if required, shall be as specified for Fill Materials. Obtain and transport borrow material at no increase to the Contract sum.

PART 3 - EXECUTION:

3.01 PROTECTION AND RESTORATION:

A. General: Provide protection to prevent settlement, movement, undermining of or erosion to existing site improvements, existing utilities, existing buildings, new site improvements, new buildings and new utilities.

B. Do not permit heavy equipment to pass over any utility until a minimum of two feet of compacted fill or backfill is placed over the top of utility.

C. Restore damage, at no increase to Contract sum, resulting from the lack of protection or improper installation of protective measures or careless execution of construction activities. Restoration work to be approved by the Soils Engineer and Owner's Representative.

3.02 EXISTING UTILITIES:

A. Notify all public utility companies, 48 hours prior to the start of earthwork operations. Verify and mark horizontal utility locations prior to the start of earthwork operation. Manually excavate and expose utilities as earthwork operations approach marked locations.

B. Immediately notify the Owner’s Representative or the Architect in the event horizontal or vertical utility locations differ from locations indicated. Provide horizontal and vertical details of utility locations as directed by the Owner’s Representative or the Architect. Conflicts with construction to be determined by the Owner’s Representative or the Architect. Payment for correction of unforeseen conflicts with construction shall be by change order.

C. Coordinate public utility relocation work required for public utilities conflicting with construction. The Owner’s Representative or the Architect will provide directions and details required to relocate utilities conflicting with construction.

D. Do not disconnect or interrupt existing utilities serving existing facilities to remain without notification and authorization of the Architect or the Owner's representatives.

3.03 DEWATERING:

A. Perform earthwork and grading operations to prevent surface or subsurface water from flowing into excavations, surface or subsurface water from flooding project site or adjacent property and water accumulations detrimental to stability of subgrades. Provide, install, operate and maintain all required pumps, sumps, discharge lines and related equipment.

3.04 DUST CONTROL AND DUST CONTROL PLAN:

A. Work under this section includes control of dust in accordance with OSHA regulations. Contractor must implement dust control techniques at all times during the work with contaminated soil to prevent the formation and migration of dust during excavation and removal of debris and soil.

B. The Contractor must implement a dust control plan. Contractor shall execute work by methods to minimize generation of dust from construction activates within the areas of contamination. Fugitive dust control strategies shall be composed of a balance of available dust mitigation techniques applied on an as needed basis by construction site supervision to: prevent dust from exiting the contaminated area work zone; prevent visible emissions from exceeding air quality regulations; and prevent public nuisance.

3.05 DECONTAMINATION:

A. Any equipment that contacts contaminated materials must be properly cleaned to mini- mize track out of contaminated materials. Contractor must deposit all disposable clothing in containers onsite and provide offsite disposal. Contractor must provide washtubs with soap and water and rinse tubs must be provided for decontamination of boots and gloves to be reused. Contaminated PPE and other contaminated disposable equipment must be collected for appropriate disposal.

B. Prior to beginning work, Contractor shall establish one or more areas on-Site for the decontamination of personnel, vehicles, and equipment leaving exclusion zones and/or exiting the Site. Decontamination areas shall allow the Engineer to conveniently observe the decontamination of equipment and vehicles leaving the Site. The location of the decontamination area will be determined by the Contractor based on staging of the Work. Contractor shall be responsible for re-locating decontamination area, as necessary,

based on Contractor's staging of Work.

C. If decontamination wastes are to be stored on-Site, Contractor shall temporarily store wastes in a contained area on-Site satisfactory to Client Representative. Contractor shall dispose of al liquid and solid decontamination wastes in accordance with applicable federal state and local regulations.

3.06 CONTAMINATED SOIL REMOVAL:

A. Contaminants of concern are expected to include non-hazardous levels of pesticides, herbicides and metals including but not limited to arsenic, lead, mercury and chromium.

B. For the purpose of this project, two types of soil may be encountered during excavation, as defined below:

1. Non-contaminated: Soil that does not contain levels of chemicals above background levels and do not exhibit an odor or visual discrepancy (such as discoloration or de- bris, etc.) to indicate otherwise.

2. Contaminated: Soil that contains laboratory quantified non- hazardous concentrations of compounds of concern above background levels as defined by the MDE, but below hazardous waste levels. If determine to be located onsite, areas of contaminated soil excavation will be provided or directed by the Engineer. Excavation of contaminated soil shall require special management practices. Area of contaminated soil excavations that cannot be immediately backfilled will be fenced.

C. Employees who will be involved in the excavation, stockpiling and loading of potentially contaminated soils and/or groundwater must receive appropriate OSHA training. The Contractor must provide 24- or 40-hour OSHA HAZWOPER-certified site workers, and provide a field Site Safety Officer that is also an 8-hour OSHA HAZWOPER supervisor trained to directly oversee potentially contaminated soil and groundwater operations. All workers in this circumstance must have their annual refresher training, medical clearance and personal protection equipment in accordance with applicable regulations.

D. The Contractor is responsible for the segregation, excavation, waste characterization, loading, transportation and offsite disposal of non-hazardous soil at the subject site in accordance with applicable regulations. The soil will require staging onsite prior to offsite disposal. The staged contaminated soil must be placed on and covered with plastic. The plastic must be a minimum of 6-mil thick. Hay bales (or similar) must be used as necessary to secure the edges of the stockpile areas. The stockpiled contaminated soil must be covered at the end of each work shift and must remained covered when not in use. Liquid including groundwater or precipitation which has contacted the stockpiled contaminated soil must not be allowed to migrate from the staging area plastic. Contaminated soil being transported offsite must have no free liquid is present, either leaving the Site or at the disposal facility. Waste characterization parameters will be contingent upon the disposal facility. The disposal facility must be permitted to accept the contaminated soil and provide evidence of such. Contractor shall submit samples under chain-of custody for laboratory analysis by an accredited laboratory. Results of the waste characterization as well as fully executed soil disposal manifests complete with weight tickets must be provided.

E. Notices of Non-Compliance and Notices of Violation: Immediately provide copies of any notices of non-compliance or notices of violation by any federal, state, or local regulatory agency issued to Contractor in relation to any work performed under this contract to Engineer. Furnish all relevant documents regarding the incident and any information requested, and coordinate the response to the notice with the Engineer prior to submission to the regulatory agencies, including the final reply to the notice, and all other responses, until the matter is resolved.

F. Final Summary Report on Contaminated Soil: Submit a Final Summary Report documenting the quantities, and the disposal activates completed on the project no later than 45 days after the completion of the project.

3.07 CONTAMINATED SOIL REUSE:

A. Contaminated soil excavated during construction may be used as backfill if deemed acceptable by MDE and the Geotechnical Engineer. Contractor is responsible for the handling and placement of the contaminated soil scheduled for reuse as backfill onsite in accordance with applicable federal state and local regulations. Contractor is responsible for placing an MDE approved geotextile atop the area of reused contaminated soil. Contractor must also follow the guidelines established above for health and safety, dust control and decontamination during the handling and placement of the contaminated soil. Contractor is responsible for providing surveyed locations and depths of the contaminated soil reused onsite.

3.08 EXCAVATION:

A. Excavate materials encountered to subgrade elevations indicated or specified by the Soils Engineer. All excavation is unclassified. Excavate materials regardless of the character of the materials encountered, at no increase to contract sum.

B. Subgrade Preparation: Upon completion of excavation activities, exposed subgrade shall be proofrolled utilizing a heavily loaded dump truck or other pneumatic-tired vehicle of similar size and weight, in the presence of the Soils Engineer. Proofrolling shall not be performed during or following wet weather conditions. Any unsuitable materials discovered during proofrolling operations shall be removed and replaced as specified below. Upon completion of proofrolling activities and approval of the subgrade by the Soils En- gineer, exposed subgrade shall be further prepared as follows:

1. Unpaved Areas: Scarify subgrade to six-inch depth prior to topsoil placement.
2. Paved Areas: Scarify subgrade to twelve-inch depth and compact to 90 percent max- imum dry density. Density test methods: ASTM D 1557. Remove unsuitable earth, exhibiting excessive weaving during compaction operations, as specified.

3.09 OVER-EXCAVATION:

A. Correct over-excavated areas as directed by the Soils Engineer. Remove unsuitable earth encountered as a direct result of over-excavation. Excavate and dispose of all unsuitable earth. Correct excavated area as directed.

3.10 UNSUITABLE EARTH:

A. Immediately notify the Soils Engineer in the event unsuitable earth is encountered during earthwork or subsequent construction operations. Stop all work within immediate area of unsuitable earth. Do not remove unsuitable earth until direction is received from the Soils Engineer. Excavate and dispose of all unsuitable earth. Backfill excavated area as specified and directed by the Soils Engineer. Removal of and backfill for unsuitable soils shall be at the Contractors expense.

3.11 EXCAVATED MATERIAL STORAGE:

A. Stockpile select excavated materials required for fill and/or backfill operations. Stockpile locations to be approved by the Owner’s Representative or the Architect. Shape and grade stockpiles to prevent ponding of surface water. Temporarily stabilize stockpiles as specified on the Soil Erosion and Sediment Control drawings. Dispose of excess excavation materials as specified.

1. Excess excavated material shall be legally disposed of by removal from the project site.

3.12 EARTH FILL:

A. Existing Ground Surface Preparation: Remove vegetation and topsoil as specified in Section 31 10 00 "Clearing". Proofroll exposed subgrade utilizing a heavily loaded dump truck or other pneumatic-tired vehicle of similar size and weight, in the presence of the Soils Engineer. Proofrolling shall not be performed during or following wet weather conditions.

B. Existing Subgrade Preparation: Remove unsuitable earth, upon completion of clearing and proofrolling operations, as specified. Continuously bench existing slopes exceeding four feet horizontal to one foot vertical. Bench sufficiently to accommodate earthmoving and compaction equipment. Select material, removed as a result of benching operations, may be used for fill and/or backfill as specified.

1. Unpaved Areas: Scarify existing subgrade to six-inch depth and compact to 85 percent maximum dry density. Density test method: ASTM D 1557.

2. Paved Areas: Scarify existing subgrade to twelve-inch depth and compact to 90 percent maximum dry density. Density test method: ASTM D 1557. Remove unsuitable earth, exhibiting excessive weaving during compaction operations, as specified.

C. Fill Placement: Do not place fill material on frozen or muddy subgrades.

1. Unpaved Areas: Place fill material in loose lifts not exceeding eight-inches.

2. Paved Areas: Place fill material in loose lifts not exceeding eight-inches.

D. Fill Compaction and Moisture Control: Obtain compaction with approved compaction equipment. Provide compaction equipment of proper size and in proper mechanical operating condition. All fill material shall be moisture conditioned to within two percent of optimum moisture content.

1. Unpaved Areas: Compact each lift to 85 percent maximum dry density. Density test method: ASTM D 1557.

2. Paved Areas: Compact each lift to 90 percent maximum dry density. Density test method: ASTM D 1557.

E. Control moisture during placement and compaction operations. Remove and replace or scarify and aerate excessively moist material until required moisture content is obtained. Moisten excessively dry material by applying measured amounts of water uniformly to fill material until required moisture content is obtained.

3.13 EARTH BACKFILL:

A. General: Backfill excavations as promptly as work permits, but not until completion of inspection, testing and approval by the Soils Engineer.

B. Placement and Compaction: Do not place backfill on frozen or muddy subgrades.

1. Unpaved Areas: Place backfill material in loose lifts not exceeding eight inches. Compact each lift to 85 percent maximum dry density. Density test method: ASTM D 1557.

2. Paved Areas: Place backfill material in loose lifts not exceeding eight inches. Compact each lift to 90 percent maximum dry density. Density test method: ASTM D 1557.

3. All material to be moisture conditioned to within two percent of optimum moisture content.

3.14 GRADING:

A. General: Grade unpaved and paved areas to smooth and uniform surfaces and to prevent ponding of surface water.

1. Unpaved Areas: Areas to receive topsoil shall be graded to allow for installation of a minimum of 6 inches of topsoil. Grade slopes exceeding four feet horizontal to one foot vertical, to smooth and uniformly rounded surfaces.

2. Paved Areas: Grade paved area subgrades to the lines, elevations and sections indicated or specified.

3.15 MAINTENANCE:

A. Maintain all paved access roads in a clean and dust free condition during earthwork or subsequent construction operations. Clean trucks and equipment, removing mud and debris, prior to entering project site access roads and public right-of-way.

B. Maintain completed areas of project site free of trash and debris. Scarify, regrade and recompact subgrades damaged or disturbed by adverse weather, soil erosion, settlement and subsequent construction operations.

3.16 TESTING:

A. The following tests will be conducted.

1. Laboratory Density Tests:

a. Test method: As specified.

b. Test interval: One test per each 15,000 s.f., or fraction thereof, of each lift of fill or backfill compacted by other than hand-operated machines, and 1 per each 5,000 s.f., etc, for areas done by hand-operated machines.

2. In-place Field Density Tests:

a. Test method: ASTM D 1556-82 or D 2167.

b. Density required: As specified.

c. Test Interval: One test per 2,000 s.f., or fraction thereof, of compacted subgrade, or of each lift of fill or backfill compacted by other than handoperated machines, and 1 per 1000 s.f., etc, for each lift of fill or backfill compacted by hand-operated machines..

B. Correct work not conforming to specified densities as directed by the Soils Engineer, at no increase to the Contract Sum.

3.17 WASTE MANAGEMENT:

A. Recycle or salvage waste earthwork materials in accordance with Division 1 “Construction Waste Management” requirements.

END OF SECTION

SECTION 31 2200
GRADING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Removal of topsoil.

B. Rough grading the site for site structures.

C. Finish grading.

1.02 RELATED REQUIREMENTS

A. Section 31 1000 - Site Clearing.

B. Section 31 2316 - Excavation.

C. Section 31 2316.13 - Trenching: Trenching and backfilling for utilities.

D. Section 31 2316.26 - Rock Removal.

E. Section 31 2323 - Fill: Filling and compaction.

F. Section 32 9219 - Seeding: Finish ground cover.

G. Section 32 9223 - Sodding: Finish ground cover.

H. Section 32 9300 - Plants: Topsoil in beds and pits.

1.03 SUBMITTALS

A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with State of Maryland, Highway Department standards.

1. Maintain one copy on site.

PART 2 PRODUCTS

2.01 MATERIALS

A. Topsoil: See Section 31 2323.

B. Other Fill Materials: See Section 31 2323.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench mark and intended elevations for the Work are as indicated.

B. Verify the absence of standing or ponding water.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Stake and flag locations of known utilities.

C. Locate, identify, and protect from damage above- and below-grade utilities to remain.

D. Notify utility company to remove and relocate utilities.

E. Provide temporary means and methods to remove all standing or ponding water from areas prior to grading.

F. Protect site features to remain, including but not limited to bench marks, survey control points, existing structures, fences, sidewalks, paving and curbs, from damage by grading equipment and vehicular traffic.

G. Protect trees to remain by providing substantial fencing around entire tree at the outer tips of its branches; no grading is to be performed inside this line.

H. Protect plants, lawns, rock outcroppings and other features to remain as a portion of final landscaping.

3.03 ROUGH GRADING

A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.

B. Do not remove topsoil when wet.

C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.

D. Do not remove wet subsoil , unless it is subsequently processed to obtain optimum moisture content.

E. When excavating through roots, perform work by hand and cut roots with sharp axe.

F. See Section 31 2323 for filling procedures.

G. Benching Slopes: Horizontally bench existing slopes greater than 1:4 to key fill material to slope for firm bearing.

H. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

I. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack surface water control.

3.04 SOIL REMOVAL

A. Stockpile excavated topsoil on site.

B. Stockpile excavated subsoil on site.

C. Stockpiles: Use areas designated on site; pile depth not to exceed 8 feet (2.5 m); protect from erosion.

3.05 FINISH GRADING

A. Before Finish Grading:

1. Verify building and trench backfilling have been inspected.
2. Verify subgrade has been contoured and compacted.

B. Remove debris, roots, branches, stones, in excess of 1/2 inch (13 mm) in size. Remove soil contaminated with petroleum products.

C. Where topsoil is to be placed, scarify surface to depth of 3 inches (75 mm).

D. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 3 inches (75 mm).

E. Place topsoil in areas indicated.

F. Place topsoil where required to level finish grade.

G. Place topsoil to the following compacted thicknesses:

1. Areas to be Seeded with Grass: 6 inches (150 mm).
2. Areas to be Sodded: 4 inches (100 mm).
3. Shrub Beds: 18 inches (450 mm).
4. Flower Beds: 12 inches (300 mm).
5. Planter Boxes: To within 3 inches (75 mm) of box rim.

H. Place topsoil during dry weather.

I. Remove roots, weeds, rocks, and foreign material while spreading.

J. Near plants spread topsoil manually to prevent damage.

K. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.

L. Lightly compact placed topsoil.

M. Maintain stability of topsoil during inclement weather. Replace topsoil in areas where surface water has eroded thickness below specifications.

3.06 TOLERANCES

A. Top Surface of Subgrade: Plus or minus 0.10 foot (1-3/16 inches) (30 mm) from required elevation.

B. Top Surface of Finish Grade: Plus or minus 0.04 foot (1/2 inch) (13 mm).

3.07 REPAIR AND RESTORATION

A. Existing Facilities, Utilities, and Site Features to Remain: If damaged due to this work, repair or replace to original condition.

B. Trees to Remain: If damaged due to this work, trim broken branches and repair bark wounds; if root damage has occurred, obtain instructions from Architect as to remedy.

C. Other Existing Vegetation to Remain: If damaged due to this work, replace with vegetation of equivalent species and size.

3.08 FIELD QUALITY CONTROL

A. See Section 31 2323 for compaction density testing.

3.09 CLEANING

A. Remove unused stockpiled topsoil and subsoil. Grade stockpile area to prevent standing water.

B. Leave site clean and raked, ready to receive landscaping.

END OF SECTION

SECTION 31 2316.13
TRENCHING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Backfilling and compacting for utilities outside the building to utility main connections.

1.02 RELATED REQUIREMENTS

A. Document : Geotechnical report; bore hole locations and findings of subsurface materials.

B. Section 03 3000 - Cast-in-Place Concrete.

C. Section 31 2200 - Grading: Site grading.

D. Section 31 2316 - Excavation: Building and foundation excavating.

E. Section 31 2316.26 - Rock Removal: Removal of rock during excavating.

F. Section 31 2323 - Fill: Backfilling at building and foundations.

G. Section 33 4100 - Subdrainage: Filter aggregate and filter fabric for foundation drainage systems.

1.03 DEFINITIONS

A. Finish Grade Elevations: Indicated on drawings.

B. Subgrade Elevations: Indicated on drawings.

1.04 REFERENCE STANDARDS

A. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses 2017.

B. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18 in.) Drop 2017.

C. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates 2014.

D. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)) 2012, with Editorial Revision (2015).

E. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method 2007.

F. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN m/m3)) 2012, with Editorial Revision (2015).

G. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method 2015.

H. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) 2011.

I. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils 2017.

J. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth) 2017.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Materials Sources: Submit name of imported materials source.

C. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.

D. Compaction Density Test Reports.

1.06 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

B. When fill materials need to be stored on site, locate stockpiles where indicated.

1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
2. Prevent contamination.
3. Protect stockpiles from erosion and deterioration of materials.

1.07 QUALITY ASSURANCE

A. All work must be done in accordance with standards and codes applicable to Prince George's County.

PART 2 PRODUCTS

2.01 FILL MATERIALS

A. General Fill: Subsoil excavated on-site.

1. Graded.
2. Free of lumps larger than 3 inches (75 mm), rocks larger than 2 inches (50 mm), and debris.
3. Conforming to ASTM D2487 Group Symbol CL.

B. Structural Fill: Subsoil excavated on-site.

1. Graded.
2. Free of lumps larger than 3 inches (75 mm), rocks larger than 2 inches (50 mm), and debris.
3. Conforming to ASTM D2487 Group Symbol CL.

C. Granular Fill: Coarse aggregate, conforming to State of Maryland Highway Department standard.

D. Granular Fill - Pea Gravel: Natural stone; washed, free of clay, shale, organic matter.

1. Grade in accordance with ASTM D2487 Group Symbol GM.
2. Graded in accordance with ASTM C136/C136M, within the following limits:
    a. Minimum Size: 1/4 inch (6 mm).
    b. Maximum Size: 5/8 inch (16 mm).

E. Sand: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter.

1. Graded in accordance with ASTM C136/C136M; within the following limits:
    a. No. 4 (4.75 mm) sieve: 100 percent passing.
    b. No. 14 (1.40 mm) sieve: 10 to 100 percent passing.
    c. No. 50 (300 micro m) sieve: 5 to 90 percent passing.
    d. No. 100 (150 micro m) sieve: 4 to 30 percent passing.
    e. No. 200 (75 micro m) sieve: 0 percent passing.

2.02 ACCESSORIES

A. Geotextile Fabric: Non-biodegradable, woven

2.03 SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for testing and analysis of soil material.

B. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.

C. If tests indicate materials do not meet specified requirements, change material and retest.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench marks and intended elevations for the work are as indicated.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. See Section 31 2200 for additional requirements.

C. Grade top perimeter of trenching area to prevent surface water from draining into trench. Provide temporary means and methods, as required, to maintain surface water diversion until no longer needed, or as directed by the Architect.

3.03 TRENCHING

A. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

B. Slope banks of excavations deeper than 4 feet (1.2 meters) to angle of repose or less until shored.

C. Do not interfere with 45 degree bearing splay of foundations.

D. Cut trenches wide enough to allow inspection of installed utilities.

E. Hand trim excavations. Remove loose matter.

F. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.

G. Remove lumped subsoil, boulders, and rock up to 1/3 cubic yard (0.25 cu m) measured by volume. See Section 31 2316.26 for removal of larger material.

H. Remove excavated material that is unsuitable for re-use from site.

I. Stockpile excavated material to be re-used in area designated in Section 31 2200.

J. Remove excess excavated material from site.

K. Provide temporary means and methods, as required, to remove all water from trenching until directed by the Architect. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

L. Determine the prevailing groundwater level prior to trenching. If the proposed trench extends less than 1 foot (305 mm) into the prevailing groundwater, control groundwater intrusion with perimeter drains routed to sump pumps, or as directed by the Architect.

3.04 PREPARATION FOR UTILITY PLACEMENT

A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

3.05 BACKFILLING

A. Backfill to contours and elevations indicated using unfrozen materials.

B. Fill up to subgrade elevations unless otherwise indicated.

C. Employ a placement method that does not disturb or damage other work.

D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

E. Maintain optimum moisture content of fill materials to attain required compaction density.

F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches (150 mm) compacted depth.

G. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches (200 mm) compacted depth.

H. Slope grade away from building minimum 2 inches in 10 feet (50 mm in 3 m), unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

I. Correct areas that are over-excavated.

1. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.

J. Compaction Density Unless Otherwise Specified or Indicated:

1. Under paving, slabs-on-grade and similar construction: 97 percent of maximum dry density.

2. At other locations: 95 percent of maximum dry density.

K. Reshape and re-compact fills subjected to vehicular traffic.

3.06 BEDDING AND FILL AT SPECIFIC LOCATIONS

A. Use general fill unless otherwise specified or indicated.

B. Utility Piping, Conduits, Duct Bank and other item identified by architect:

1. Bedding: Use general fill.

2. Cover with general fill.

3. Fill up to subgrade elevation.

4. Compact in maximum 8 inch (200 mm) lifts to 95 percent of maximum dry density.

C. At Pipe Culverts:

1. Bedding: Use general fill.

2. Place filter fabric specified in Section 33 0513 over compacted bedding.

3. Cover with general fill.

4. Fill up to subgrade elevation.

5. Compact in maximum 8 inch (200 mm) lifts to 95 percent of maximum dry density.

D. Over Subdrainage Piping at Foundation Perimeter and Under Slabs:

1. Drainage fill and geotextile fabric: Section 33 4100.

2. Cover drainage fill with general fill.

3. Compact to 95 percent of maximum dry density.

E. At French Drains:

1. Use granular fill.
2. Fill up to 8 inches (200 mm) below finish grade.
3. Compact to 95 percent of maximum dry density.

3.07 TOLERANCES

A. Top Surface of General Backfilling: Plus or minus 1 inch (25 mm) from required elevations.

B. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch (25 mm) from required elevations.

3.08 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection and testing.

B. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167 or ASTM D6938.

C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D1557 ("modified Proctor"), AASHTO T 180 or ASTM D698 ("standard Proctor").

D. If tests indicate work does not meet specified requirements, remove work, replace and retest.

E. Frequency of Tests: at beginning of each shift.

3.09 CLEANING

A. Leave unused materials in a neat, compact stockpile.

B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

C. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION

SECTION 31 2316.26
ROCK REMOVAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Removal of identified rock during excavation.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

B. Section 31 2323 - Fill: Fill materials.

1.03 DEFINITIONS

A. Site Rock: Solid mineral material with a volume in excess of 1/3 cubic yard (0.25 cubic meter) or solid material that cannot be removed with a 3/4 cubic yard (0.57 cubic meter) capacity power shovel without drilling.

B. Trench Rock: Solid mineral material with a volume in excess of 1/6 cubic yard (0.13 cubic meter) or solid material that cannot be removed with a capacity power shovel without drilling.

C. Rock: Solid mineral material of a size that cannot be removed with a capacity power shovel.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate the proposed method of blasting, delay pattern, explosive types, type of blasting mat or cover, and intended rock removal method.

1.05 QUALITY ASSURANCE

A. Seismic Survey Firm: Company specializing in seismic surveys with five years documented experience.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify site conditions and note subsurface irregularities affecting work of this section.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum.

3.03 ROCK REMOVAL

A. Excavate and remove rock by mechanical methods only; use of explosives is prohibited.

B. Mechanical Methods: Drill holes and utilize expansive tools to fracture rock.

C. Form level bearing at bottom of excavations.

D. Remove shaled layers to provide sound and unshattered base for footings.

E. In utility trenches, excavate to 6 inches (150 mm) below invert elevation of pipe and 24 inches (600 mm) wider than pipe diameter.

F. Remove excavated materials from site.

G. Correct unauthorized rock removal in accordance with backfilling and compacting requirements of Section 31 2323.

3.04 ROCK DISPOSAL

A. Dispose of surplus removed rock off site. Dispose in locations acceptable to authorities having jurisdiction and Owner's Representative.

3.05 FIELD QUALITY CONTROL

A. Do not dispose removed rock into landfill. Material must be sent to appropriate location as approved by the Owner's Representative.

B. Independent agency field inspection will be provided under provisions of Section 01 4000 - Quality Requirements.

END OF SECTION

SECTION 31 2316
EXCAVATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Excavating for building volume below grade, footings, pile caps, slabs-on-grade, paving, site structures and utilities within the building.

B. Trenching for utilities outside the building to utility main connections.

C. Temporary excavation support and protection systems.

1.02 RELATED REQUIREMENTS

A. Section 01 5713 - Temporary Erosion and Sediment Control: Slope protection and erosion control.

B. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring. General requirements for dewatering of excavations and water control.

C. Section 02 4100 - Demolition: Shoring and underpinning existing structures.

D. Section 21 0553 - Identification for Fire Suppression Piping and Equipment: Underground warning tapes at underground fire suppression lines.

E. Section 22 0553 - Identification for Plumbing Piping and Equipment: Underground warning tapes at underground plumbing lines.

F. Section 23 0553 - Identification for HVAC Piping and Equipment: Underground warning tapes at underground HVAC lines.

G. Section 26 0553 - Identification for Electrical Systems: Underground warning tapes at underground electrical lines.

H. Section 31 1000 - Site Clearing: Vegetation and existing debris removal.

I. Section 31 2200 - Grading: Soil removal from surface of site.

J. Section 31 2200 - Grading: Grading.

K. Section 31 2316.13 - Trenching: Excavating for utility trenches outside the building to utility main connections.

L. Section 31 2316.26 - Rock Removal: Removal of rock during excavating.

M. Section 31 2323 - Fill: Fill materials, backfilling, and compacting.

N. Section 31 3700 - Riprap.

O. Section 33 4100 - Subdrainage: Filter aggregate and filter fabric for foundation drainage systems.

1.03 REFERENCE STANDARDS

A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards current edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Temporary Support and Excavation Protection Plan.

C. Project Record Documents: Record drawings at project closeout according to 01 7000 - Execution and Closeout Requirements. Show locations of installed support materials left in place, including referenced locations and depths, on drawings.

D. Shoring Installer's Qualification Statement.

E. Field Quality Control Submittals: Document visual inspection of load-bearing excavated surfaces.

1.05 QUALITY ASSURANCE

A. Temporary Support and Excavation Protection Plan:

1. Indicate sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property.

2. Include drawings and calculations for bracing and shoring.

3. Bracing and shoring design to meet requirements of OSHA’s Excavation Standard, 29 CFR 1926, Subpart P.

B. Designer Qualifications: For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in Maryland.

C. Shoring Installer Qualifications: Company specializing in performing the shoring and bracing work of this section with minimum five years of documented experience.

PART 2 PRODUCTS

2.01 MATERIALS

A. Bedding and Fill to Correct Over-Excavation:

1. See Section 31 2323 for bedding and corrective fill materials at general excavations.

2. See Section 31 2316.13 for bedding and corrective fill materials at utility trenches.

B. Underground Warning Tapes:

1. See Section for 21 0553 underground warning tapes at underground fire suppression lines.

2. See Section for 22 0553 underground warning tapes at underground plumbing lines.

3. See Section for 23 0553 underground warning tapes at underground HVAC lines.

4. See Section for 26 0553 underground warning tapes at underground electrical lines.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench mark and intended elevations for the work are as indicated.

B. Survey existing adjacent structures and improvements and establish exact elevations at fixed points to act as benchmarks.

1. Resurvey benchmarks during installation of excavation support and protection systems and notify Owner if any changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

C. Determine the prevailing groundwater level prior to excavation. If the proposed excavation extends less than 1 foot (305 mm) into the prevailing groundwater, control groundwater intrusion with perimeter drains routed to sump pumps, or as directed by Architect. If the proposed excavation extends more than 1 foot (305 mm) into the prevailing groundwater, control groundwater intrusion with a comprehensive dewatering procedures, or as directed by Geotechnical Engineer.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. See Section 31 1000 for clearing, grubbing, and removal of existing debris.

C. See Section 31 2200 for topsoil removal.

D. Locate, identify, and protect utilities that remain and protect from damage.

E. Notify utility company to remove and relocate utilities.

F. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving and curbs from excavating equipment and vehicular traffic.

G. Protect plants, lawns, rock outcroppings and other features to remain.

H. Grade top perimeter of excavation to prevent surface water from draining into excavation. Provide temporary means and methods, as required, to maintain surface water diversion until no longer needed, or as directed by Architect.

I. See Sections 01 7000 and 02 4100 for underpinning and shoring of adjacent structures that could be damaged by excavating work.

3.03 TEMPORARY EXCAVATION SUPPORT AND PROTECTION

A. Excavation Safety: Comply with OSHA's Excavation Standard, 29 CFR 1926, Subpart P.

1. Excavations in stable rock or in less than 5 feet (1.5 m) in depth in ground judged as having no cave-in potential do not require excavation support and protection systems.

2. Depending upon excavation depth, time that excavation is open, soil classification, configuration and slope of excavation sidewalls, design and provide an excavation support and protection system that meets the requirements of 29 CFR 1926, Subpart P:

a. Sloping and benching systems.

b. Support systems, shield systems, and other protective systems.

B. Leave excavation support and protection systems, used as formwork or within 10 feet (3.03 m) of existing foundations, permanently in place, unless otherwise noted.

C. Excavation support and protection systems not required to remain in place may be removed subject to approval of Owner or Owner's Representative.

1. Remove temporary shoring and bracing in a manner to avoid harmful disturbance to underlying soils and damage to buildings, structures, pavements, facilities and utilities.

3.04 EXCAVATING

A. Excavate to accommodate new structures and construction operations.

1. Excavate to the specified elevations.

2. Excavate to the length and width required to safely install, adjust, and remove any forms, bracing, or supports necessary for the installation of the work.

3. Cut utility trenches wide enough to allow inspection of installed utilities.

4. See Section 31 2316.26 for required excavation clearances for pipes in utility trenches.

5. Hand trim excavations. Remove loose matter.

B. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

C. Preparation for Piling Work: Excavate to working elevations. Coordinate special requirements for piling.

D. Do not interfere with 45 degree bearing splay of foundations.

E. Remove lumped subsoil, boulders, and rock up to 1/3 cubic yard (0.25 cu m) measured by volume. See Section 31 2316.26 for removal of larger material.

F. Provide temporary means and methods, as required, to remove all water from excavations until directed by Architect. Remove and replace soils deemed suitable by classification and which are excessively moist due to lack of dewatering or surface water control.

3.05 SUBGRADE PREPARATION

A. See Section 31 2323 for subgrade preparation at general excavations.

B. See Section 31 2316.13 for subgrade preparation at utility trenches.

3.06 FILLING AND BACKFILLING

A. Do not fill or backfill until all debris, water, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from excavation.

B. Install underground warning tape at buried utilities according to Sections 21 0553, 22 0553, 23 0553 and 26 0553.

C. See Section 31 2323 for fill, backfill, and compaction requirements at general excavations.

D. See Section 31 2316.13 for fill, backfill, and compaction requirements at utility trenches.

E. See Section 31 2200 for rough and final grading and topsoil replacement requirements.

3.07 REPAIR

A. Correct areas that are over-excavated and load-bearing surfaces that are disturbed; see Section 31 2323.

3.08 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection and testing.

B. Provide for visual inspection of load-bearing excavated surfaces by Architect before placement of foundations.

3.09 CLEANING

A. Stockpile excavated material to be re-used in area designated on site in accordance with Section 31 2200.

B. Remove excavated material that is unsuitable for re-use from site.

C. Remove excess excavated material from site.

3.10 PROTECTION

A. Divert surface flow from rains or water discharges from the excavation.

B. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.

C. Protect open excavations from rainfall, runoff, freezing groundwater, or excessive drying so as to maintain foundation subgrade in satisfactory, undisturbed condition.

D. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

E. Keep excavations free of standing water and completely free of water during concrete placement.

END OF SECTION

SECTION 31 2323
FILL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Filling, backfilling, and compacting for building volume below grade.

B. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.

C. Lightweight concrete fill.

1.02 RELATED REQUIREMENTS

A. Section 01 5713 - Temporary Erosion and Sediment Control: Slope protection and erosion control.

B. Section 03 3000 - Cast-in-Place Concrete.

C. Section 13 4713 - Cathodic Protection.

D. Section 31 2200 - Grading: Removal and handling of soil to be re-used.

E. Section 31 2200 - Grading: Site grading.

F. Section 31 2316 - Excavation: Removal and handling of soil to be re-used.

G. Section 31 2316.13 - Trenching: Excavating for utility trenches outside the building to utility main connections.

H. Section 31 3700 - Riprap.

I. Section 32 1413 - Precast Concrete Unit Paving: Leveling bed placement under pavers.

J. Section 32 1416 - Brick Unit Paving: Leveling bed placement under pavers.

K. Section 32 1440 - Stone Paving: Leveling bed placement under pavers.

L. Section 33 4100 - Subdrainage: Filter aggregate and filter fabric for foundation drainage systems.

1.03 DEFINITIONS

A. Finish Grade Elevations: Indicated on drawings.

B. Subgrade Elevations: 4 inches (100 mm) below finish grade elevations indicated on drawings, unless otherwise indicated.

1.04 REFERENCE STANDARDS

A. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses 2017.

B. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18 in.) Drop 2017.

C. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates 2014.

D. ASTM C150/C150M - Standard Specification for Portland Cement 2018.

E. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete 2012.

F. ASTM C796/C796M - Standard Test Method for Foaming Agents for Use in Producing Cellular Concrete Using Preformed Foam 2012.

G. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)) 2012, with Editorial Revision (2015).

H. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method 2007.

I. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN m/m3)) 2012, with Editorial Revision (2015).

J. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method 2015.

K. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) 2011.

L. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils 2017.

M. ASTM D6817/D6817M - Standard Specification for Rigid Cellular Polystyrene Geofoam 2017.

N. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth) 2017.

O. ASTM D7557/D7557M - Standard Practice for Sampling of Expanded Geofoam Specimens 2009, with Editorial Revision (2013).

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data for Manufactured Fill.

C. Shop Drawings for Manufactured Fill.

1. Submit plan, section, and profile drawings. Indicate size, type, location, and orientation of each geofoam block.

2. Submit location and type of connectors.

3. Indicate proposed weighting or guying.

D. Soil Samples: 10 pounds (4.5 kg) sample of each type of fill; submit in air-tight containers to testing laboratory.

E. Materials Sources: Submit name of imported materials source.

F. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used, including manufactured fill.

G. Compaction Density Test Reports.

H. Lightweight Concrete Test Reports.

I. Manufacturer's Instructions.

J. Designer's Qualification Statement.

K. Manufacturer's Qualification Statement.

L. Lightweight Concrete Fill Installer's Qualification Statement.

M. Testing Agency Qualification Statement.

N. Specimen Warranty.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Perform design of structural fill under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in Maryland.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

C. Lightweight Concrete Fill Applicator Qualifications: Company specializing in performing work of the type specified and with at least 13,000 cubic yards (10,000 cu m) in five years of documented experience and approved by manufacturer.

D. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

E. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

B. When fill materials need to be stored on site, locate stockpiles where indicated.

1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
2. Prevent contamination.
3. Protect stockpiles from erosion and deterioration of materials.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide ten year manufacturer warranty for manufactured fill material.

PART 2 PRODUCTS

2.01 FILL MATERIALS

A. General Fill: Subsoil excavated on-site.

1. Graded.
2. Free of lumps larger than 3 inches (75 mm), rocks larger than 2 inches (50 mm), and debris.
3. Conforming to ASTM D2487 Group Symbol CL.

B. Structural Fill: Subsoil excavated on-site.

1. Graded.
2. Free of lumps larger than 3 inches (75 mm), rocks larger than 2 inches (50 mm), and debris.
3. Conforming to ASTM D2487 Group Symbol CL.

C. Concrete for Fill: As specified in Section 03 3000; compressive strength of 2500 psi (17.235 MPa).

D. Granular Fill - Gravel : Pit run washed stone; free of shale, clay, friable material and debris.

1. Graded in accordance with ASTM D2487 Group Symbol GW.

E. Granular Fill - Pea Gravel: Natural stone; washed, free of clay, shale, organic matter.

1. Graded in accordance with ASTM C136/C136M, within the following limits:
   a. Minimum Size: 1/4 inch (6 mm).
   b. Maximum Size: 5/8 inch (16 mm).

F. Sand: Natural river or bank sand; free of silt, clay, loam, friable or soluble materials, and organic matter.

1. Graded in accordance with ASTM C136/C136M; within the following limits:
    a. No. 4 (4.75 mm) sieve: 100 percent passing.
    b. No. 14 (1.40 mm) sieve: 10 to 100 percent passing.
    c. No. 50 (300 micro m) sieve: 5 to 90 percent passing.
    d. No. 100 (150 micro m) sieve: 4 to 30 percent passing.
    e. No. 200 (75 micro m) sieve: 0 percent passing.

G. Topsoil: See Section 31 2200.

H. Engineered Fill - Lightweight Concrete:
1. Finished Properties, Class II Engineered Fill:
    a. Cast Density, Maximum: 30 pounds per cubic foot (480 kg/cu m).
    b. Compressive Strength, Minimum: 41 pounds per square inch (280 kPa).
2. Materials:
    a. Cement: ASTM C150/C150M.
    b. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.
    c. Admixtures: As recommended by lightweight concrete fill manufacturer.
    d. Expansion Material: Manufacturer's recommended expansion material.
    e. Mix Design: By manufacturer.

2.02 ACCESSORIES

A. Geotextile Fabric: Non-biodegradable, woven .

B. Vapor Retarder: 10 mil (0.25 mm) thick, polyethylene.

2.03 SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for testing and analysis of soil material.

B. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.

C. If tests indicate materials do not meet specified requirements, change material and retest.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench marks and intended elevations for the Work are as indicated.

B. Identify required lines, levels, contours, and datum locations.

C. See Section 31 2200 for additional requirements.

D. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.

E. Verify structural ability of unsupported walls to support imposed loads by the fill.

F. Verify areas to be filled are not compromised with surface or ground water.

3.02 PREPARATION

A. Scarify and proof roll subgrade surface to a depth of 6 inches (150 mm) to identify soft spots.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.03 FILLING

A. Fill to contours and elevations indicated using unfrozen materials.

B. Fill up to subgrade elevations unless otherwise indicated.

C. Employ a placement method that does not disturb or damage other work.

D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

E. Maintain optimum moisture content of fill materials to attain required compaction density.

F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches (150 mm) compacted depth.

G. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches (200 mm) compacted depth.

H. Slope grade away from building minimum 2 inches in 10 feet (50 mm in 3 m), unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

I. Correct areas that are over-excavated.

1. Load-bearing foundation surfaces: Use structural fill, flush to required elevation, compacted to 100 percent of maximum dry density.

2. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.

J. Compaction Density Unless Otherwise Specified or Indicated:

1. Under paving, slabs-on-grade and similar construction: 97 percent of maximum dry density.

2. At other locations: 95 percent of maximum dry density.

K. Reshape and re-compact fills subjected to vehicular traffic.

L. Maintain temporary means and methods, as required, to remove all water while fill is being placed as required, or until directed by the Architect. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

3.04 ENGINEERED FILL - LIGHTWEIGHT CONCRETE

A. Install lightweight concrete fill according to manufacturer's written instructions.

B. Use batching, mixing, and placing equipment approved by the manufacturer.

C. Prevent segregation of material.

D. Tolerance: Finished surface within 2 inches (50 mm) of elevation indicated on drawings.

3.05 FILL AT SPECIFIC LOCATIONS

A. Use general fill unless otherwise specified or indicated.

B. Under Interior Slabs-On-Grade:

1. Use granular fill.

2. Depth: 4 inches (100 mm) deep.

3. Compact to 95 percent of maximum dry density.

4. Cover with sand.
    a. Depth: 2 inches (50 mm).
    b. Compact to 95 percent of maximum dry density.

C. At Foundation Walls and Footings:
1. Use general fill.
2. Fill up to subgrade elevation.
3. Compact each lift to 90 percent of maximum dry density.
4. Do not backfill against unsupported foundation walls.
5. Backfill simultaneously on each side of unsupported foundation walls until supports are in place.

D. Over Subdrainage Piping at Foundation Perimeter and Under Slabs:
1. Drainage fill and geotextile fabric: Section 33 4100.
2. Cover drainage fill with general fill.
3. Fill up to subgrade elevation.
4. Compact to 95 percent of maximum dry density.

E. Over Buried Utility Piping, Conduits and Duct Bank in Trenches:
1. Bedding: Use general fill.
2. Cover with general fill.
3. Fill up to subgrade elevation.
4. Compact in maximum 8 inch (200 mm) lifts to 95 percent of maximum dry density.

F. At Interior Crawl Spaces:
1. Use general fill.
2. Compact to 90 percent of maximum dry density.
3. Install vapor retarder over entire exposed surface.
4. Cover with granular fill, 2 inches (50 mm) deep.

G. Inside Planter Boxes:
1. Use granular fill, 4 inches (100 mm) deep.
2. Cover with geotextile fabric.
3. Cover with sand, 2 inches (50 mm) deep.
4. Finish with topsoil, to within 2 inches (50 mm) of planter rim, lightly tamped.

H. At Lawn Areas:
1. Use general fill.
2. Fill up to 6 inches (150 mm) below finish grade elevations.
3. Fill up to subgrade elevations.
4. Compact to 95 percent of maximum dry density.
5. See Section 31 2200 for topsoil placement.

I. At Planting Areas Other Than Lawns :

1. Use general fill.
2. Fill up to 12 inches (300 mm) below finish grade elevations.
3. Fill up to subgrade elevations.
4. Compact to 95 percent of maximum dry density.
5. See Section 31 2200 for topsoil placement.

J. At French Drains:

1. Use granular fill.
2. Fill up to 8 inches (200 mm) below finish grade.
3. Compact to 95 percent of maximum dry density.

K. Under Pavers Set on Sand Leveling Bed:

1. Use granular fill.
2. Fill up to bottom of sand leveling bed.
3. Compact to 95 percent of maximum dry density.
4. See unit pavers section for leveling bed placement.

3.06 TOLERANCES

A. Top Surface of General Filling: Plus or minus 1 inch (25 mm) from required elevations.

B. Top Surface of Filling Under Paved Areas: Plus or minus 1 inch (25 mm) from required elevations.

3.07 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection and testing.

B. Soil Fill Materials:

C. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167 or ASTM D6938.

D. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D698 ("standard Proctor"), ASTM D1557 ("modified Proctor") or AASHTO T 180.

E. If tests indicate work does not meet specified requirements, remove work, replace and retest.

F. Frequency of Tests: daily.

G. Proof roll compacted fill at surfaces that will be under slabs-on-grade.

H. Engineered Fill - Lightweight Concrete:

1. Sampling: During initial placement, take four 3 inch by 6 inch (76 mm by 152 mm)3 inch by 6 inch (76 mm by 152 mm) test specimens per 303 cubic yards (230 cu m) of material placed or for each four hours of placement work.
2. Testing: Provide third-party testing of samples in accordance with ASTM C796/C796M except do not oven-dry load-test specimens.

3.08 CLEANING

A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

C. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION

SECTION 31 3116
TERMITE CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Chemical soil treatment.

B. Termite-resistant vapor barrier sheet.

C. Termite exclusion materials.

D. Site-applied termiticide for wood, steel, and concrete.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Vapor barrier placement under concrete slab-on-grade.

B. Section 06 0573 - Wood Treatment: Field-applied termiticide for wood.

1.03 REFERENCE STANDARDS

A. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs 2011 (Reapproved 2017).

B. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs 2017.

C. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act 2006.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.

C. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements.

D. Test Reports: Indicate regulatory agency approval reports when required.

E. Manufacturer's Certificate: Certify that toxicants meet or exceed specified requirements.

F. Certificate of compliance from authority having jurisdiction indicating approval of toxicants.

G. Manufacturer's Instructions: Indicate caution requirement.

H. Record and document moisture content of soil before application.

I. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three (3) years of documented experience.

J. Maintenance Data: Indicate re-treatment schedule .

K. Warranty: Submit warranty and ensure that forms have been completed in Owner 's name.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing this type of work and:

1. Having minimum of three (3) years documented experience.
2. Approved by manufacturer of treatment materials.
3. Licensed in Maryland .

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year installer's warranty against damage to building caused by termites.

1. Include coverage for repairs to building and to contents damaged due to building damage. Repair damage and, if required, re-treat.

2. Inspect annually and report in writing to Owner . Provide inspection service for five years from Date of Substantial Completion.

C. Termite-Resistant Vapor Barrier Sheet: Provide five year manufacturer's limited warranty.

PART 2 PRODUCTS

2.01 CHEMICAL SOIL TREATMENT

A. Toxicant Chemical: Local authority approved; synthetically color dyed to permit visual identification of treated soil. Per PGCPS stanards, Termite control chemicals should not contain properlene glycol. Should the choice be limiting, other means such as barrier sheets should be exploted.

B. Diluent: Recommended by toxicant manufacturer.

C. Manufacturers:

1. Bayer Environmental Science Corp: www.backedbybayer.com/pest-management/#sle.Bayer Environmental Science Corp: www.backedbybayer.com/pest-management/#sle.Bayer Environmental Science Corp: www.backedbybayer.com/pest-management/#sle.

2. FMC Professional Solutions: www.fmcprosolutions.com/#sle.

3. Syngenta Professional Products: www.syngentaprofessionalproducts.com/#sle.

4. Substitutions: See Section 01 6000 - Product Requirements.

D. Mixes: Mix toxicant to manufacturer's instructions.

2.02 SITE-APPLIED TERMITICIDE

A. Site Applied Termiticide for Wood, Steel and Concrete: Borate mineral salt based, spray applied termiticide formulated for use on wood, steel, concrete and other building materials.

1. Active Ingredient: 40% minimum disodium octaborate tetrahydrate (DOT). Per PGCPS stanards, Termite control chemicals should not contain properlene glycol. Should the choice be limiting, other means such as barrier sheets should be exploted.

2.03 TERMITE BARRIER SHEET

A. Termite-Resistant Vapor Barrier Sheet: Plastic sheet, complying with ASTM E1745, Class C; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs, and for exclusion of subterranean termites.

B. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, prefabricated boots, etc., for sealing seams and penetrations in vapor retarder.

C. NOTE: This specification consists of furnishing and installing a complete stainless steel mesh barrier system or graded basaltic barrier sand at allpenetrations, joints and perimeter foundations as a physical barrier below the concrete slabs and foundations of a structure to prevent the entry of Formosan and other ground termites into wood components of the structure, similar to laying down a chemical barrier of soil termiticide treatments. The use of these materials does not preclude the use of other preventive measures such as chemical treatment and pressure treated lumber for construction to provide maximum protection to the structure. In fact, it is recommended that these materials be used in conjunction with chemical treatment at all vulnerable areas such as penetration areas around electrical conduits and plumbing pipes that penetrate the slab as well as the foundation perimeter and shoulder portions of he

barrier. These termite barriers must comply with all codes. It is also recommended that pressure treated lumber be used to provide maximum protection to the structure.

D. Manufacturers:

1. Stego Technology LLC; Pango Wrap with Pango Tape: www.stegoindustries.com/#sle.
2. Substitutions: See Section 01 6000 - Product Requirements.

2.04 TERMITE EXCLUSION PARTICLE BARRIER

A. Particle Barrier: Selected granular fill material; weight, granularity, hardness, and installed compaction prevent termite intrusion into foundations or structure without poisons or other chemicals.

1. Products:

a. Polyguard Barrier Systems, Inc, a division of Polyguard Products, Inc; TERM Particle Barrier: www.polyguardbarriers.com/#sle.

2.05 TERMITE EXCLUSION BARRIER SYSTEM

A. Multiple Component Barrier System: Selected granular fill material, mesh, barrier sheet, and sealant; mechanical properties prevent termite intrusion into foundations or structure without poisons or other chemicals.

1. Products:

a. Polyguard Barrier Systems, Inc, a division of Polyguard Products, Inc; TERM All Pest Bath Trap Barrier: www.polyguardbarriers.com/#sle.

b. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.

B. Verify final grading is complete.

3.02 APPLICATION - CHEMICAL TREATMENT

A. Comply with requirements of U.S. EPA and applicable state and local codes.

B. Spray apply toxicant in accordance with manufacturer's instructions.

C. Apply toxicant at following locations:

1. Under Slabs-on-Grade.
2. In Crawl Spaces.
3. At Both Sides of Foundation Surface.
4. Soil Within 10 feet (3 m) of Building Perimeter For a Depth of [4 feet] feet ([1.21] m).

D. Under slabs, apply toxicant immediately prior to installation of vapor barrier.

E. At foundation walls, apply toxicant immediately prior to finish grading work outside foundations.

F. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.

G. Re-treat disturbed treated soil with same toxicant as original treatment.

H. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

3.03 INSTALLATION - SITE-APPLIED TERMITICIDE

A. Comply with manufacturer's written instructions.

3.04 INSTALLATION - BARRIER SHEET

A. Comply with ASTM E1643.

B. Lap joints minimum 6 inches (150 mm). Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions.

3.05 INSTALLATION - EXCLUSION SYSTEM

A. Particle Barrier: Comply with manufacturer's written instructions.

B. Barrier System: Comply with manufacturer's written instructions.

3.06 PROTECTION

A. Do not permit soil grading over treated work.

B. Protect sheet materials from damage after completed installation. Repair damage with manufacturer's recommended products and according to the manufacturer's written instructions.

END OF SECTION

SECTION 31 3700
RIPRAP

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Riprap in sacks.

1.02 RELATED REQUIREMENTS

A. Section 31 2323 - Fill: Aggregate requirements.

1.03 QUALITY ASSURANCE

A. Perform Work in accordance with State of Maryland Highways standard.

B. Maintain one copy of each document on site.

C. Furnish each aggregate material from single source throughout the Work.

PART 2 PRODUCTS

2.01 MATERIALS

A. Riprap: Provide in accordance with State of Maryland Highways standards.

B. Aggregate: Granular fill as specified in Section 31 2323.

C. Bags: Woven jute.

D. Binder: Portland cement.

E. Geotextile Fabric: Non-biodegradable, woven .

2.02 BAGGED RIPRAP

A. Mix riprap, cement , sand and aggregate dry. Limit quantity of cement to 10 percent of dry mixed materials by volume.

B. Fill bags with dry ingredients to 70 percent capacity and close by sewing or stapling to a straight seam.

2.03 SUSTAINABILITY CHARACTERISTICS

A. Section 018113 - Sustainable Design Requirements: Requirements for sustainable design compliance.

PART 3 EXECUTION

A. Materials and Resources Characteristics:

1. Recycled Content Materials: Furnish materials with maximum available recycled content.

2. Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project site.

3.02 EXAMINATION

A. Do not place riprap bags over frozen or spongy subgrade surfaces.

3.03 PLACEMENT

A. Place geotextile fabric over substrate, lap edges and ends.

B. Place riprap at culvert pipe ends, embankments slopes and as indicated.

C. Installed Thickness: as directed on drawings.

D. Place rock evenly and carefully over bagged riprap to minimize voids, do not tear bag fabric, place bags and rock in one consistent operation to preclude disturbance or displacement of substrate.

E. After placement, spray with water to moisten the bagged mix. Maintain moist for 24 hours.

3.04 SCHEDULES

A. Culvert Pipe Ends: Bagged, placed one layer thick, 6 inch (150 mm) average thickness, concealed with topsoil fill.

B. Sloped Grade At Retaining Wall: Individual riprap units, 6 inch (150 mm) thickness; placed prior to finish topsoil.

END OF SECTION

SECTION 31 4000
TEMPORARY SHORING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions and Division One through Division Five Specification Sections, apply to work of this Section.

1.02 REFERENCE STANDARDS

A. Latest Editions of Prince George's County Design Manuals, Maryland State Highway Standards and Specifications and 2011 MDE Soil Erosion and Sediment Control Manual.

B. Pertinent requirements of the "Occupational and Health Standards for the Construction Industry," as promulgated by OSHA.

1.03 WORK DESCRIPTION

A. Design and construct temporary shoring at excavations to prevent collapse of adjacent materials, and to protect workmen, the general public, structural and site components associated with the Work, and adjacent properties and structure.

B. The Contractor shall be solely responsible for materials, means and methods for construction of temporary shoring.

C. The Contractor shall secure all required approvals, including PG County DPIE, and adjacent property owners if required.

1.04 SUBMITTALS

A. Comply with provisions of PG County Design Manual for preparation, review, and approval of construction documents for temporary shoring.

1. Construction documents shall be prepared, signed, and sealed by a Registered Design Professional, licensed by the State of Maryland, and experienced in the design of temporary shoring.
2. Construction documents shall be reviewed and approved by PG County DPIE prior to beginning work requiring temporary shoring.
3. Submit three (3) copies of approved construction documents to architect for record and distribution to Owner.

1.05 QUALITY ASSURANCE

A. Use adequate numbers of workmen, who are trained and experienced in the installation of temporary shoring, and who are familiar with the requirements and methods required by this Section, for proper, safe performance of shoring.

B. Coordinate shoring design and construction with the following:

1. The Geotechnical Report
2. Structural Systems included in the Work
3. Site Structures included in the Work
4. Existing adjacent structures affected by work requiring temporary shoring

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide all materials necessary to construct the temporary shoring, in accordance with the approved construction documents.

PART 3 - EXECUTION

3.01 CONDITIONS

A. Examine the areas and conditions under which the work of this Section shall be performed. Correct conditions detrimental to proper installation and safe performance of the temporary shoring. Do not proceed until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Install the temporary shoring in strict conformance with the approved construction documents.

3.03 CLEANUP

A. After work requiring temporary shoring is completed, remove all materials and components associated with the shoring, and remove from site. Dispose of excess materials and debris in a legal manner.

END OF SECTION

SECTION 31 5000
EXCAVATION SUPPORT AND PROTECTION

PART 1 – GENERAL:

1.01 SUMMARY

A. Work of this section includes sheeting and shoring and bracing.

1.02 RELATED SECTIONS

A. Section 31 10 00: Clearing

B. Section 31 20 00: Earthmoving

1.03 SYSTEM DESCRIPTION DESIGN REQUIREMENTS

A. Shoring systems shall be designed to safely and adequately prevent collapse of adjacent materials and permit construction of Work to arrangement shown on Contract Documents.

B. Secure approvals, including those of local governmental agencies having jurisdiction.

C. Analyze site conditions. Make supplemental investigations as needed for proper design of shoring.

1.04 QUALITY ASSURANCE SUBMITTALS FOR DESIGN DATA

A. Prepare and submit design drawings and calculations showing analysis of work to be performed, including horizontal support for shoring.

B. Drawings shall include methods, equipment and work procedures.

1.05 QUALITY ASSURANCE

A. Qualifications

1. Bracing and shoring drawings shall be prepared by a registered professional engineer, licensed to practice in the State of Maryland. Drawings and calculations shall bear seal of Professional Engineer registered in the State of Maryland.

2. Personnel performing installation shall be trained or qualified in techniques and procedures of shoring installation with a minimum of three (3) years successful experience in such installation.

3. Installation shall be performed under supervision of a Professional Engineer registered in the State of Maryland, experienced in this type of work.

B. Regulatory Requirements: Conform to requirements of Occupational Safety and Health Administration (OSHA) as well as measures accepted as standards of industry.

C. Certifications: Upon completion of shoring, submit a letter signed and sealed by design engineer stating that, to best of his or her knowledge, systems were constructed in compliance with design drawings and calculations.

1.06 LEED SUBMITTALS

A. Product data for Credit MR 4.: For products having recycled content, documentation indicating percentages by weight of pre-consumer and post-consumer recycled content. Include statement indicating cost of each product with recycled content.

B. Product data for Credit MR 5: For products having regional material content, documentation indicating location of manufacture and location of extraction, recovery or harvest of primary raw materials. Include statement indicating cost of each product with regional material content.

C. Certificates for Credit MR 7: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include vendor invoice indicating Chain

of Custody number and wood products listed per requirements Section 01 60 00 Product Requirements.

PART 2 – PRODUCTS:

2.01 MATERIALS

A. Materials shall be selected and furnished to perform in compliance with design criteria.

B. Structural Steel Shapes and Plates: ASTM A 36 or ASTM A 572. Steel shall be of American manufacturer, new and free from defects in strength, durability, appearance and function.

1. Recycled Content: Provide steel with minimum 90 percent total recycled content, including at least 60 percent post-consumer recycled content.

2. Regional Materials: Provide steel manufactured and of primary raw materials extracted or recovered within 500 mile radius of Project Site.

C. Forest Certification: To the extent necessary to meet required LEED threshold, provide wood products made from forests certified by an FSC-accredited certification body. All non-FSC wood in assemblies with FSC-certified wood shall meet the FSC Controlled Wood (CW) criteria.

PART 3 – EXECUTION:

3.01 EXAMINATION

A. Site Verification of Conditions: Prior to commencing work of this Section, check and verify governing dimensions and elevations, including field measurements of existing or adjoining work on which this work is dependent to assure proper fit and clearances between new and existing structures.

3.02 PREPARATION

A. Protection

1. Protect and support water, sewer, gas, and other pipes and electrical conduits encountered and immediately notify persons, companies or governmental agencies, granting them ample opportunity to take such additional precautions as they may deem necessary.

2. Cut and cap street connections encountered in excavating along curb lines in compliance with local jurisdiction requirements. Mark locations of capped utilities so they may be subsequently located and reconnected as needed.

3. Damage to adjacent properties, streets, sidewalks and utilities caused by work under this Section shall be repaired, restored to original condition, or replaced at no additional expense to Owner.

B. Coordination

1. Prepare a photographic or video survey of existing crack conditions in adjacent facilities and other conditions of structures prior to commencing work.

2. Maintain free flow of pedestrian and vehicular traffic to and from adjacent properties at levels existing prior to start of work and as described in Section 02000 “Clearing”.

3. Interior bracing shall be arranged to offer no interference with formwork for new construction.

4. Provide sufficient quantity of materials on hand at all times for protection of Work and for use in event of emergency.

5. Setting of formwork, reinforcing and placement of concrete shall be in compliance with requirements described in other related Sections of this Project Manual.

6. Provide pumps and other equipment as necessary to dewater excavations for shoring operations.

C. Sheeting

1. Provide sheeting of proper lengths and section needed, and anchor or brace to resist earth and hydrostatic pressures and superimposed loads from adjacent structures and/or construction equipment.
2. Install sheeting plumb and true, to lines and locations as indicated on design submittal drawings. Sheeting shall be used to form concrete walls and shall be located and driven to ensure that no part of sheeting is within outline of permanent construction.
3. Sheeting retaining earth on which support and stability of existing structures is dependent shall be left in place at completion of Work.

D. Shoring

1. Locate shoring at distances away from new construction sufficient to allow working room and observation of construction.
2. Shoring shall be set clear of permanent footings, walls and other structural features.
3. Shoring shall be installed to retain earth under surcharges, including such loads as weight of construction materials and equipment, vibration, snow, rainwater, water absorption by soils, and temporary construction.
4. Extend shoring as high as necessary to allow for construction of foundation walls and for berming to divert water run-off. Depth of shoring shall be as deep as necessary to brace excavation to ultimate depth.
5. Shoring supporting formwork may not be left in place upon written approval by the Owner's Representative.

3.03 RESTORATION

A. Remove temporary protective installations upon completion of shoring operations.

B. Repair damage to structures caused by shoring operations and restore surfaces to original or better condition.

3.04 CLEANING

A. Remove debris and excess earth resulting from shoring operations as it accumulates. Do not store debris on site or permit debris to be scattered over site.

END OF SECTION

SECTION 31 6213.19
PRECAST CONCRETE PILES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Prestressed precast concrete piles with steel points.

1.02 RELATED REQUIREMENTS

A. Section 31 0916.21 - Pile Load Tests: Requirements for pile load tests.

1.03 REFERENCE STANDARDS

A. ASTM A416/A416M - Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete 2017.

B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2018, with Editorial Revision (2018).

C. PCI MNL-116 - Manual for Quality Control for Plants and Production of Structural Precast Concrete Products 1999.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

B. Scheduling: Schedule pile driving to occur between the hours of 8:00 and 4:30 pm.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide details of points.

C. Shop Drawings: Indicate details and schedule of pile installation sequence. Identify recommended pile length and size to suit design requirements.

D. Certificate of compliance from authority having jurisdiction indicating approval.

E. Designer's Qualification Statement.

F. Installer's Qualification Statement.

G. Project Record Documents: Accurately record the following:

1. Sizes, lengths, and locations of piles.
2. Sequence of driving.
3. Number of blows per foot (meter) for entire length of piles and measured set for last 10 blows.
4. Piles requiring drilling and the hole diameters.
5. Final base and top elevations.
6. Driving force of each hammer blow.

1.06 QUALITY ASSURANCE

A. Fabricate in accordance with requirements of PCI MNL-116.

B. Design and select pile components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in Maryland.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum [five] years of documented experience.

PART 2 PRODUCTS

2.01 MATERIALS

A. Concrete: Minimum 5,000 psi (34 MPa) 28 day strength, normal portland cement; aggregates and sand as recommended by pile manufacturer.

B. Tensioning Steel Tendons: ASTM A416/A416M; Grade 250 - 250K psi (1725 MPa) tensile strength, seven-wire stranded steel cable; low-relaxation type; full length without splices.

C. Reinforcing Steel: ASTM A615/A615M, Grade 40 (40,000 psi) (280 MPa) yield strength, deformed steel bars.

2.02 FABRICATION

A. Pile Points: Hardened steel, hollowed tip to minimize bounce or deflection.

B. Pile Section Joint Ends: Male and female, with positive lock, formed steel.

C. Pile Connectors: Fabricated of steel angles, fitted to outside dimensions of square pile ends.

D. Shop fabricate pile in maximum practical lengths to meet design requirements.

2.03 SOURCE QUALITY CONTROL

A. Provide shop testing and inspection of piles under provisions of Section 01 4000.

B. Test concrete for compressive strength in accordance with quality control requirements of PCI MNL-116.

PART 3 EXECUTION

3.01 PREPARATION

A. Obtain prior approval of hammer type to be used.

B. Use driving method that will not cause damage to nearby structures.

C. Notify adjacent and affected land owners and building occupants with 90 days notice before proceeding with the Work.

D. Protect structures near the Work from damage.

3.02 DRILLING

A. Drill holes to facilitate driving only if piling cannot be completed in specified manner. Drill only through strata that obstructs driving.

B. Hole Diameter: Maximum 1 inch (25 mm) larger than tip dimension.

3.03 INSTALLATION

A. Drive piles to defined load supporting capacity.

B. Protect pile head during driving, using cushion cap with full bearing on pile butt for even distribution of hammer blow.

C. Deliver hammer blows to central axis of pile.

D. Do not damage piles during driving operations.

E. If driving is interrupted before refusal, drive an additional 12 inches (300 mm) before resuming recording of performance data.

F. Re-drive piles that have lifted due to driving adjacent piles, or by soil uplift.

G. Prepare pile top to receive pile caps.

3.04 TOLERANCES

A. Maximum Variation From Vertical For Plumb Piles: 1 in 48.

B. Maximum Variation From Required Angle For Batter Piles: 1 in 24.

C. Maximum Variation From Pile Cut-off Elevation: 4 inches (100 mm).

D. Maximum Out-of-Position: 2 inches (50 mm).

3.05 FIELD QUALITY CONTROL

A. Field inspection will be performed under provisions of Section 01 4000.

B. Perform load tests to requirements of Section 31 0916.21.

C. Test Piles: Same diameter and type as specified for other piling, placed in same manner.

D. Accepted test piles may not be used in the Work.

3.06 UNACCEPTABLE PILES

A. Unacceptable Piles: Piles that fail tests, are placed out of position, are below cut-off elevations, or are damaged.

B. Provide additional piles or replace piles to conform to specified requirements.

END OF SECTION

SECTION 31 6216.16
STEEL H PILES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rolled steel section piles.

1.02 RELATED REQUIREMENTS

A. Section 31 0916.21 - Pile Load Tests: Requirements for pile load tests.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.

B. ASTM A690/A690M - Standard Specification for High-Strength Low-Alloy Nickel, Copper, Phosphorus Steel H-Piles and Sheet Piling with Atmospheric Corrosion Resistance for Use in Marine Environments 2013a (Reapproved 2018).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

B. Scheduling: Schedule pile driving to occur between the hours of 8:00 am and 4:30 pm.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide details of collars.

C. Shop Drawings: Indicate details and schedule of pile installation sequence. Identify recommended pile length and shapes to suit design loads.

D. Manufacturer's Mill Certificate: Certify that steel casings meets or exceeds specified requirements.

E. Certificate of compliance from authority having jurisdiction indicating approval.

F. Designer's Qualification Statement.

G. Installer's Qualification Statement.

H. Project Record Documents: Accurately record the following:

1. Sizes, lengths, and locations of piles.
2. Sequence of driving.
3. Number of blows per foot (meter) for entire length of piles and measured set for last 10 blows.
4. Identify piles requiring drilling, and hole diameters.
5. Final base and top elevations.
6. Driving force of each hammer blow.

1.06 QUALITY ASSURANCE

A. Design and select pile components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in Maryland.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years of documented experience.

C. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

PART 2 PRODUCTS

2.01 MATERIALS

A. Piles: ASTM A690/A690M; structural steel, rolled H sections, minimum 50 ksi (345 MPa) yield strength; sizes and lengths indicated.

B. Piles: ASTM A36/A36M; structural steel, rolled HP sections, minimum 36 ksi (250 MPa) yield strength; sizes and lengths indicated.

C. Accessories: Points, driving cap; to suit pile shape.

D. Protective Coating:

2.02 SOURCE QUALITY CONTROL

A. Provide shop testing and inspection of piles under provisions of Section 01 4000.

2.03 FABRICATION

A. Coat pile with specified protective cover in accordance with manufacturer's instructions.

B. Allow to cure before driving piles.

PART 3 EXECUTION

3.01 PREPARATION

A. Obtain prior approval of hammer type to be used.

B. Use driving method that will not cause damage to nearby structures.

C. Notify adjacent and affected land owners and building occupants with 90 days notice before proceeding with the Work.

D. Protect structures near the Work, from damage.

E. Prepare to place piles from existing site elevations.

3.02 INSTALLATION

A. Drive piles to defined load supporting capacity.

B. Protect pile head during driving, using cushion cap with full bearing on pile butt for even distribution of hammer blow.

C. Deliver hammer blows to central axis of pile.

D. If driving is interrupted before refusal, drive an additional 12 inches (300 mm) before resuming recording of performance data.

E. Re-drive piles that have lifted due to driving adjacent piles, or by soil uplift.

F. Do not damage piles during driving operations.

G. Cut off tops of piles to elevations indicated and prepare pile top to receive pile caps.

3.03 TOLERANCES

A. Maximum Variation From Vertical For Plumb Piles: 1 in 48.

B. Maximum Variation From Required Angle For Batter Piles: 1 in 24.

C. Maximum Variation From Pile Cut-off Elevation: 4 inches (100 mm).

D. Maximum Out-of-Position: 2 inches (50 mm).

3.04 FIELD QUALITY CONTROL

A. Field inspection will be performed under provisions of Section 01 4000.

B. Perform load tests to requirements of Section 31 0916.21.

C. Test Piles: Same diameter and type as specified for other piling, placed in same manner.

D. Accepted test piles may not be used in the Work.

3.05 UNACCEPTABLE PILES

A. Unacceptable Piles: Piles that fail tests, are placed out of position, are below cut-off elevations, or are damaged.

B. Provide additional piles or replace piles to conform to specified requirements.

END OF SECTION

SECTION 32 0190
OPERATION AND MAINTENANCE OF PLANTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Maintain plants in manner that promotes health, growth, color and appearance, to quality levels specified; replace dead, dying, and damaged plants at no extra cost to Owner .

1. It is Contractor 's responsibility to determine type and quantity of soil amendments and fertilizer required.
2. Perform soil analysis to determine type and quantity of soil amendments; test enough soil samples to obtain a comprehensive analysis; submit reports.

B. Maintain newly planted landscape plants, including turf (lawns), turf (playfields), trees, shrubs, hedges, vines, ground cover, perennials, flowering bulbs and annuals.

C. Maintain established landscape plants, including turf (lawns), turf (playfields), trees, shrubs, hedges, vines, ground cover, perennials, flowering bulbs and naturalized wildflowers.

D. Renovate the following established landscape plants within the project boundaries: turf (lawns), turf (playfields), trees, regardless of size, shrubs, hedges, vines, ground cover, perennials and naturalized wildflowers.

E. Clean up landscaped areas.

F. Maintenance Period: The time frame covered by these requirements is 90 days:

1. Start Date: Project Date of Substantial Completion.

1.02 RELATED REQUIREMENTS

A. Section 01 5713 - Temporary Erosion and Sediment Control.

B. Section 31 2200 - Grading.

C. Section 32 9219 - Seeding.

D. Section 32 9223 - Sodding.

E. Section 32 9300 - Plants.

1.03 REFERENCE STANDARDS

A. ANSI A300 Part 1 - American National Standard for Tree Care Operations -- Tree, Shrub and Other Woody Plant Maintenance -- Standard Practices 2017.

B. ANSI Z133.1 - American National Standard For Arboricultural Operations - Pruning, Repairing, Maintaining, And Removing Trees, And Cutting Brush - Safety Requirements 2012.

C. ASTM C602 - Standard Specification for Agricultural Liming Materials 2013a.

D. ASTM D4972 - Standard Test Method for pH of Soils 2018.

1.04 PROPOSAL SUBMITTALS

A. Submit complete maintenance plan, showing:

1. Irrigation volume and frequency.
2. Fertilizer type, quantity, and schedule of application.
3. Soil amendment type, quantity, and schedule of application.
4. Personnel assigned, including supervisor.

5. Inspection procedures, diagnostics, and remedies.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Soil Tests and Analysis: Submit report showing number of samples, test results, and recommendations for soil amendments and fertilizer.

C. Product Data: Manufacturer's data sheets on each fertilizer, herbicide, pesticide, and other chemical material to be used, showing trade name, chemical composition, mixing instructions, recommended application rate, storage and handling instructions, and application instructions.

1. Pesticides and Herbicides: Also include U.S. EPA registration number and Material Safety Data Sheets.

D. Shop Drawings:

1. Maintenance plan.

2. Recommendations of the local Cooperative Extension Service office for maintenance and care of turf.

3. Pesticide application plan; obtain approval of Owner for each individual pesticide application.

E. Certificates: Certification of composition of the following as delivered:

1. Fertilizer.

2. Mulch.

3. Pesticides.

4. Herbicides.

5. Other chemical materials.

F. Installer Qualifications: As specified.

G. Site Reports: Include date, time, personnel, condition of plants, activities, temperature, precipitation, irrigation applied; record:

1. Each visit for maintenance purposes.

2. Volume of water applied and area applied to.

3. Diagnosis for treatment of unhealthy plants.

4. Pesticide application; provide all additional reports and recordkeeping required by law.

5. Herbicide application; provide all additional reports and recordkeeping required by law.

6. Removal of dead plants, with quantity and diagnosis.

7. Replanting.

8. Volume of bio-degradable debris composted.

9. Volume of wood chips produced.

10. Volume of debris removed from site.

1.06 QUALITY ASSURANCE

A. Installer Qualifications:

1. Maintenance Contractor: The contractual entity that performed the planting installation.

2. Pruners: Certified member, or supervised by certified member, of International Society of Arboriculture.
3. Pesticide Applicators: Certified by authorities having jurisdiction.
4. Herbicide Applicators: Certified by authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver U.S. EPA-controlled materials to site in original containers with legible labels indicating registration number and registered uses.

B. Deliver fertilizer and manufactured soil amendments to site in original containers bearing manufacturer's chemical analysis, name, trade name or trademark, and indication of compliance with applicable state and federal laws and regulations ; alternatively, bulk delivery with equivalent certificate is acceptable.

C. Store fertilizer, soil amendments, and mulch in dry locations away from contaminants.

D. Do not store pesticides, herbicides, or other chemical treatment materials in locations where they could damage seeds or plants.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fertilizers:

B. Antidessicants:

C. Plant Growth Regulators:

D. Pesticides:

E. Herbicides:

F. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FERTILIZERS AND SOIL AMENDMENTS

A. Fertilizers: Free flowing granular organic type containing nitrogen, phosphorus, and potassium, plus trace minerals and micro-nutrients; controlled release type is preferred.

1. Determine type and quantity based on soil analysis.
2. Turf Fertilizer: As specified in Section 32 9219.
3. Non-Turf Plant Fertilizer: As specified in Section 32 9300.

B. Soil Amendments: Type and quantity as required to achieve specified results, based on soil analysis.

C. pH Adjuster: ASTM C602 Class O limestone.

D. Gypsum: Commercially packaged, free flowing, minimum 95 percent calcium sulfate by volume.

E. Sand: Clean and free of materials harmful to plants; 95 percent by weight, minimum, passing No.10 ((2 mm) sieve and 10 percent by weight, minimum, passing No.16 ((1.18 mm) sieve.

F. Calcined Clay: Granular particles produced from montmorillonite clay calcined to minimum temperature of 1200 degrees F (650 degrees C).

1. Gradation:
   a. 90 percent, minimum, passing No.8 ((2.36 mm) sieve.
   b. 99 percent, minimum, retained on No.60 ((0.25 mm) sieve.
   c. 2 percent, maximum, passing No.100 ((0.15 mm) sieve.

2. Density: 40 pounds per cubic foot (640 kg per cubic meter).

G. Decomposed Wood Derivatives: Ground bark, sawdust, humus or other green wood waste material; free of stones, sticks, and fully composted or stabilized with nitrogen.

H. Recycled Compost: Well decomposed, stable, weed free; derived from food, agricultural or industrial residuals, biosolids, yard trimmings, or source-separated or mixed solid waste; with no objectionable odors and not resembling the raw material from which it was made; no substances toxic to plants.

1. Gradation: 100 percent passing 3/8 inch (10 mm) screen.
2. Moisture Content: 35 to 55 percent by weight.
3. pH: 5.5 to 8.9.
4. Not more than 1 percent man-made matter and without plastic items more than 2 inches (50 mm) in length.

I. Bonemeal: Finely ground, steamed, with 2 to 4 percent nitrogen and 16 to 40 percent phosphoric acid.

2.03 APPLIED MATERIALS

A. Antidessicants: Sprayable, water insoluble film-forming material that produces a moisture retarding barrier not removable by rain or snow.

1. Film-Forming Temperature: Temperature commonly encountered out of doors during planting season.
2. Moisture Vapor Transmission: 0.2 pounds (10 grams) per 24 hours at 70 percent humidity, maximum.

B. Plant Growth Regulators: Sprayable, foliar absorbed non-translocatable liquid; not for application via permanent irrigation system.

C. Organic Mulch: Maintain general appearance of existing mulched areas; use one of the following types:

1. Wood chips ranging in size from 1/2 inch (12 mm) to one inch (25 mm).
2. Ground or shredded bark.
3. Shredded hardwood ranging in size from 1/2 inch (12 mm) to one inch (25 mm).
4. Bark peelings ranging in size from 1/2 inch (12 mm) to one inch (25 mm).
5. Pine straw.
6. Marsh hay.
7. Recovered 100 percent wood-based materials ranging in size from 1/2 inch (12 mm) to one inch (25 mm).

D. Inorganic Mulch: Match existing mulched areas.

E. Pesticides: U.S. EPA registered.

F. Herbicides for Use on Turf: U.S. EPA registered.

G. Water: Suitable for irrigation; Owner 's water supply may be used.

PART 3 EXECUTION

3.01 EXAMINATION

A. If soil analysis has not already been performed, take sufficient samples to obtain a comprehensive analysis; perform analysis in accordance with ASTM D4972.

3.02 LANDSCAPE MAINTENANCE - GENERAL

A. Obtain and follow the maintenance instructions provided by the installer of new plant materials.

B. Protect existing vegetation, pavements, and facilities from damage due to maintenance activities; restore damaged items to original condition or replace, at no extra cost to Owner .

C. General Cleanup: Remove debris from all landscape areas at least once a week and from turf areas before each mowing.

   1. Debris consists of trash, rubbish, dropped leaves, downed branches and limbs of all sizes, dead vegetation, rocks, and other material not belonging in landscaped areas.

   2. Remove debris from site and dispose of properly.

D. Watering, Soil Erosion, and Sedimentation Control: Comply with federal, state, local, and other regulations in force; prevent over-watering, run-off, erosion, puddling, and ponding.

   1. Site grading and planting have been designed to resist erosion once fully grown, with temporary measures in place during establishment period.

   2. Repair temporary erosion control mechanisms provided by others.

   3. Repair eroded areas and replant, when caused by inadequate maintenance.

   4. Prevent sediment from entering storm drains.

E. Trees: Exercise care to avoid girdling trees; provide protective collars if necessary; remove protective collars at end of maintenance period.

F. Fertilizing: Apply fertilizer only when necessary.

G. Drainage Channels: Remove obstructions in gutters, catch basins, storm drain inlets, yard drains, swales, ditches, and overflows.

   1. Remove grates from catch basins to clean.

   2. Prevent encroachment of other vegetation on turfed surface drainage channels.

H. Health Maintenance: Inspect all plants regularly for health:

   1. Eradicate diseases and damaging pests, regardless of severity or speed of effect.

   2. Treat accidental injuries and abrasions.

   3. If a plant is unhealthy but not yet dead, according to specified definitions, determine reason(s) and take remedial action immediately.

   4. Remove dead plants immediately upon determining that they are dead.

I. Pesticide and Herbicide Application: Comply with manufacturer's instructions and recommendations and applicable regulations.

   1. Obtain Owner 's approval prior to each application.

   2. Apply in manner to prevent injury to personnel and damage to property due to either direct spray or drifting, both on and off Owner 's property.

   3. Use backflow preventers on hose bibbs used for mixing water; prevent spills.

   4. Inspect equipment daily before application; repair leaks, clogs, wear, and damage.

   5. Do not dispose of excess mixed material, unmixed material, containers, residue, rinse water, or contaminated articles on site; dispose of off site in legal manner.

   6. Rinse water may be used as mix water for next batch of same formulation.

7. Contractor is responsible for all recordkeeping, submissions, and reports required by laws and regulations.

J. Winterizing: Prepare designated plants for winter as described:

K. Replanting: Perform replacement and replanting immediately upon removal of dead plant.

3.03 IRRIGATION

A. Irrigation: Do not allow plants to wilt; apply water as required to supplement rainfall; do not waste water; do not water plants or areas not needing water; do not water during rainfall; shut off water flow when finished; repair leaks.

1. No automatic irrigation system is available; provide hoses and other equipment as required.
2. Do not drive water trucks over turf, seeded areas, or planting beds.
3. Provide backflow preventers on hose bibbs used for irrigation hoses.

3.04 RENOVATION OF ESTABLISHED TURF

A. Remove turf from around trees to radius of 18 inches (450 mm) from base of tree trunk. Cut turf out and remove; do not simply mow. Trim turf edge as specified.

B. Trim perimeter of turf area and around intervening objects as specified under Turf Maintenance.

C. Eliminate undesirable grasses and weeds. Remove as much thatch as possible.

D. Aerate established turf at least once every two years by coring and pulling out soil plugs 2 to 3 inches (50 to 75 mm) deep and not more than 2 inches (50 mm) apart.

1. Leave the plugs on the turf until the soil has been washed from them, then remove.
2. Clean plugs from pavements immediately.

E. Apply fertilizer over entire aerated area.

F. After aeration, seed entire aerated area as specified in Section 32 9219; rake or brush seed into contact with soil.

G. When soil amendments are necessary, apply as top dressing to entire aerated area after overseeding to depth of 1/4 inch (6 mm); blend top dressing mixture thoroughly before applying.

H. Water as soon as possible after planting. Do not allow newly planted material to become dry.

I. Fertilize again 3 to 4 weeks after seeding.

J. Begin normal mowing once grass reaches 1-1/2 times specified mowing height.

3.05 TURF MAINTENANCE

A. Maintain turf in manner required to produce turf that is healthy, uniform in color and leaf texture, and free from weeds and other undesirable growth.

1. Grass Density - Lawns: 20 plants per square foot (200 plants per square meter), minimum.
2. Bare Spots - Lawns: 2 percent of total area, maximum; 6 inches (150 mm) square, maximum.
3. Keep turf relatively free of thatch, woody plant roots, diseases, nematodes, soil-borne insects, stones larger than 1 inch (25 mm) in diameter, and other materials detrimental to grass growth.
4. Limit broadleaf weeds and patches of foreign grass to a maximum of 2 percent of the total area.
5. When new grass is planted in existing turf areas, quality will be evaluated when grass is 1 inch (25 mm) high.

B. Mowing: During growing season(s) mow turf to uniform height, in manner that prevents scalping, rutting, bruising, and uneven or rough cutting.
   1. Prior to mowing clean all debris and leaves from turf surface.
   2. Schedule frequency of mowing so that no more than one-quarter to one-third of grass leaf length is removed during a cutting.
      a. Maximum grass height before mowing: 4 inches (100 mm).
      b. Height of turf is measured from the soil surface.
   3. Make each successive mowing at approximately 45 degrees to the previous mowing, if practical.
   4. Cool Season Grasses:
      a. Reduce mowing height in fall and spring.
      b. Use rotary type mowers; mulcher type mowers may be used.
   5. Warm Season Grasses:
      a. Increase mowing height slightly as fall approaches.
      b. Use reel type mowers; do not use mulcher mowers.

C. Summer Mowing Height for Lawns:
   1. Bahiagrass: 3 inches (75 mm).
   2. Bermuda, Common: 2 inches (50 mm).
   3. Bluegrass: 3 inches (75 mm).
   4. Fescue, Creeping Red: 3 inches (75 mm).
   5. Fescue, Fine: 2 inches (50 mm).
   6. Fescue, Tall: 4 inches (100 mm).
   7. Rye, Annual: 3 inches (75 mm).
   8. Rye, Perennial: 3 inches (75 mm).
   9. St. Augustine, Common: 4 inches (100 mm).
   10. St. Augustine, Improved: 3 inches (75 mm).

D. Mowing Playfields:
   1. Mowing Frequency: Once a week.

E. Mowing Naturalized Grass Areas:
   1. Mowing Frequency: One a season.

F. Trimming: Immediately after each mowing, neatly trim perimeter of each turf area and around obstructions within turf area; match height and appearance of adjacent turf.
   1. Adjacent to Pavements: Cut edges of turf to form a distinct, uniform turf edge.
   2. Adjacent to Planting Beds and Permanently Mulched Areas: Cut edges of turf to form a distinct, uniform turf edge.
   3. Around Other Trees and Poles: Where no planting bed or mulched area exists, trimming with string trimmer is acceptable.
   4. At Fences: Trim on both sides of fence.

5. Irrigation Heads and Valve Boxes: Trim neatly so grass doesn't interfere with operation.

G. Fertilizer: Apply as recommended by manufacturer and at rate indicated by soil analysis.

1. Cool Season Grasses: Apply at least once, in Fall before first frost; do not apply high nitrogen fertilizer during Summer; Spring application is optional but must be reduced in quantity.

H. Reseeding: Comply with requirements of Section 32 9219.

I. Resodding: Comply with requirements of Section 32 9223.

3.06 PLANTING BED MAINTENANCE

A. Planting beds include all planted areas except turf.

B. Begin maintenance immediately after plants have been installed; inspect at least once a week and perform needed maintenance promptly.

C. Keep planting beds free of pests; remove weeds and grass by hand before reaching 1 inch (25 mm) height.

D. Do not allow climbing, twining, or creeping plants to encroach into other species.

E. Ground Cover and Vines:

1. Trim to encourage dense, well-developed growth covering intended areas.

2. Do not allow plants to grow up trees, shrubs, or vines or encroach into turf or drainage channels, unless the drainage channel is intended to be planted with ground cover.

3. Remove existing plants grown up trees, shrubs, and vines.

F. Flowering Plants: Remove dead flower heads; do not trim off leaves of flowering bulbs until they are brown.

G. Replace mulch as required and remove debris.

3.07 TREE AND SHRUB MAINTENANCE

A. Trees will be considered dead when main leader has died back or when 25 percent or more of crown has died ; except as otherwise indicated for palm trees.

B. Shrubs will be considered dead when 25 percent or more of plant has died.

C. Inspect woody plants for health by scraping up to 1/16 inch (2 mm) square area of bark; no green cambium layer below bark shall be evidence of death.

D. Adjust stakes, guys and turnbuckles, ties, and trunk wrap as required to promote growth and avoid girdling.

E. Fertilizing: Fertilize all trees at least once during maintenance period, preferably in the Fall; use accepted standards for determining type and method of fertilization.

F. Pruning: Unless otherwise indicated, prune only to maintain balanced natural shape; follow recommendations of ANSI A300 and ANSI Z133.1 and best local practices for species involved.

G. Shrubs: Prune at least once during maintenance period at best time to influence ultimate shape and size for the particular species.

1. Prune to balance the plant's form and according to its natural growth characteristics.

2. Remove water shoots, suckers, and branches not conforming to desired shape and size.

H. Hedges: Trim to encourage growth into voids and gaps.

1. Formal Hedges: Trim to two feet high by three feet wide with base slightly wider than top and sides uniformly sloped; trim as often as necessary to maintain dimensions within 3 inches (75 mm) of specified dimensions.
2. Informal Hedges: Trim to six feet high, shaped naturally; trim as often as necessary to maintain dimensions within 6 inches (150 mm) of specified dimensions.

I. Young Trees: Prune at least once during maintenance period at best time to influence ultimate shape and size for the particular species; do not remove or cut off leader.

J. Renovation of Established Shrubs: Prune and trim as required to improve shape and balance as appropriate to the particular species; remove dead, damaged, and diseased branches and limbs; do not remove excess growth except as follows:

1. Remove growth in front of windows, above or obstructing entranceways and walkways, leaning against structures, and obstructing vision at street intersections.

K. Renovation of Established Trees (Except Palm Trees):

1. Remove dead, damaged, and diseased branches and limbs and structurally weak limbs that may be a safety hazard.
2. Remove growth in front of windows, above or obstructing entranceways and walkways, and leaning against structures.
3. Remove growth obstructing traffic signs or vision at street intersections.
4. Remove branches that extend over buildings or otherwise endanger roofs.
5. Remove low-hanging branches over vehicular traffic routes to height necessary to clear expected traffic including buses and moving vans.
6. Where indicated, remove excess growth by pruning technique best suited to future growth for the particular species.

3.08 CLEANING

A. Remove fallen deciduous leaves in Fall; removal may wait until all leaves have fallen.

B. Clean adjacent pavements of plant debris and other debris generated by maintenance activities.

C. Remove and dispose of general cleanup debris and biodegradable debris in a proper manner; Owner 's trash collection facilities may be used.

D. Remove and dispose of general cleanup debris and biodegradable debris in a proper manner.

1. Biodegradable Debris: Owner will designate a compost pile on site where biodegradable debris may be deposited; branches and bark are not considered biodegradable.
2. Branches and Bark: Owner will designate a wood chip storage area; machine-chip all branch and bark debris.
3. Non-Biodegradable Debris: Owner 's trash collection facilities may be used.

3.09 CLOSEOUT ACTIVITIES

A. 10 days prior to end of maintenance period, submit request for final inspection.

B. Final inspection will be conducted by Architect .

END OF SECTION

SECTION 32 1123
AGGREGATE BASE COURSES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aggregate base course.

B. Paving aggregates.

1.02 RELATED REQUIREMENTS

A. Section 31 2200 - Grading: Preparation of site for base course.

B. Section 31 2316.13 - Trenching: Compacted fill over utility trenches under base course.

C. Section 31 2323 - Fill: Topsoil fill at areas adjacent to aggregate base course.

D. Section 31 2323 - Fill: Compacted fill under base course.

E. Section 32 1125 - Turf Surfaced Roadways: Additional aggregate base course requirements.

F. Section 32 1216 - Asphalt Paving: Finish and binder asphalt courses.

G. Section 32 1313 - Concrete Paving: Finish concrete surface course.

H. Section 32 1413 - Precast Concrete Unit Paving.

I. Section 32 1416 - Brick Unit Paving.

J. Section 32 1440 - Stone Paving.

K. Section 33 0513 - Manholes and Structures: Manholes including frames.

L. Section 33 4100 - Subdrainage: Filter aggregate and filter fabric for foundation drainage systems.

1.03 REFERENCE STANDARDS

A. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses 2017.

B. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18 in.) Drop 2017.

C. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates 2014.

D. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)) 2012, with Editorial Revision (2015).

E. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method 2007.

F. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN m/m3)) 2012, with Editorial Revision (2015).

G. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method 2015.

H. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) 2011.

I. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth) 2017.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Samples: 10 lb (4.5 kg) sample of each type of aggregate; submit in air-tight containers to testing laboratory.

C. Materials Sources: Submit name of imported materials source.

D. Aggregate Composition Test Reports: Results of laboratory tests on proposed and actual materials used.

E. Compaction Density Test Reports.

1.05 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

B. When aggregate materials need to be stored on site, locate where directed by Owner.

C. Aggregate Storage, General:

1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
2. Prevent contamination.
3. Protect stockpiles from erosion and deterioration of materials.

1.06 QUALITY ASSURANCE

A. Single Source: Furnished from single source throughout Work.

B. Certification: Certify that source of materials for this Work meets these Specifications and provide tests required to prove that Work-in-progress meets requirements of these Specifications.

C. Installation by a contractor specializing in the work, and a minimum of ten (10) years of documented experience for successful, high quality installations of aggregate base specified herein.

PART 2 PRODUCTS

2.01 MATERIALS

A. Coarse Aggregate: Coarse aggregate, conforming to State of Maryland Highway Department standard.

B. Coarse Aggregate: Natural washed stone; free of shale, clay, friable material and debris.

1. Graded in accordance with ASTM D2487 Group Symbol GW.

C. Blended Aggregate: Pit run stone; free of shale, clay, friable material and debris.

1. Graded in accordance with ASTM D2487 Group Symbol GW.

D. Medium Aggregate: Natural stone; pea gravel, washed, free of clay, shale, organic matter.

1. Grade in accordance with ASTM D2487 Group Symbol GM.

E. Fine Aggregate: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter.

1. Grade in accordance with ASTM D2487 Group Symbol SW.

F. Herbicide: .

2.02 SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for testing and analysis of aggregate materials.

B. Where aggregate materials are specified using ASTM D2487 classification, test and analyze samples for compliance before delivery to site.

C. Where aggregate materials are specified using ASTM D2487 classification, testing of samples for compliance will be provided before delivery to site.

D. If tests indicate materials do not meet specified requirements, change material and retest.

E. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench marks and intended elevations for the work are as indicated.

B. Verify substrate has been inspected, gradients and elevations are correct, and is dry.

3.02 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.

B. Do not place aggregate on soft, muddy, or frozen surfaces.

3.03 INSTALLATION

A. Under Bituminous Concrete Paving:

1. Place {CH#14505} to a total compacted thickness of {CH#14506}.
2. Compact to 95 percent of maximum dry density.

B. Under Portland Cement Concrete Paving:

1. Place coarse aggregate to a total compacted thickness of [6 inches] inches ([____] mm).
2. Compact to 95 percent of maximum dry density.

C. Place aggregate in maximum 4 inch (100 mm) layers and roller compact to specified density.

D. Level and contour surfaces to elevations and gradients indicated.

E. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.

F. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.

G. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

H. Apply herbicide to finished surface.

3.04 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch (6.4 mm) measured with 10 foot (3 m) straight edge.

B. Scheduled Compacted Thickness: Within 1/4 inch (6.4 mm).

C. Variation From Design Elevation: Within 1/2 inch (12.8 mm).

3.05 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection and testing.

B. Compaction density testing will be performed on compacted aggregate base course in accordance with ASTM D1556, ASTM D2167 or ASTM D6938.

C. If tests indicate work does not meet specified requirements, remove work, replace and retest.

3.06 CLEANING

A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

B. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION

SECTION 32 1125
TURF SURFACED ROADWAYS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water-permeable, turf surfaced aggregate base for infrequent vehicular traffic.

1.02 RELATED REQUIREMENTS

A. Section 31 2200 - Grading: Preparation of subbase.

B. Section 32 0190 - Operation and Maintenance of Planting: Turf maintenance.

C. Section 32 1123 - Aggregate Base Courses: Product and execution requirements for aggregate base course.

D. Section 32 1413 - Precast Concrete Unit Paving: Permeable paving accomplished using open grid concrete pavers.

E. Section 32 9223 - Sodding: Product and execution requirements for sodding.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's printed product literature on all products specified in this section; include installation instructions.

C. Samples: Two full sized pieces of individual turf reinforcement units, or minimum 1 foot (300 mm) square piece of roll reinforcement, whichever is applicable.

D. Certificates: Certify that products of this section meet or exceed specified requirements.

E. Maintenance Data: Manufacturer's precautions for maintenance of turf and turf reinforcement.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years of experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Turf Reinforcement Manufacturers:

1. Invisible Structures, Inc: www.invisiblestructures.com/#sle.
2. NDS, Inc: www.ndspro.com/#sle.
3. Presto-Geosystems, Co: www.prestogeo.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Aggregate Base Course: Comply with requirements of Section 32 1123 with the following exceptions:

1. Sieve Analysis: For long term porosity provide:
   a. 100 percent passing 3/4 inch (19 mm) sieve.
   b. 85 percent passing 3/8 inch (9.5 mm) sieve.

c. 60 percent passing #4 sieve.

d. 30 percent passing #40 sieve.

e. Less than 3 percent passing #200 sieve.

2. pH: Between 6.5 and 7.2.

B. Moisture Absorbent Crystals: Dry synthetic crystal made of polyacrylamide (less than 0.1 percent) polymer; non-toxic and neutral in Ph; capable of absorbing 150 to 350 times its weight in water from most tap sources and capable of absorbing fertilizers and other minerals without degradation.

C. Turf Reinforcement: Plastic rings or grids for sand and grass fill, interlocking to form continuous reinforcement over roadway area, with geotextile on bottom.

1. Load Bearing Capacity: 365 psi (256,620 kg/sq m), minimum.

2. Material: Polyolefin or Polyethylene , up to 100 percent recyclable.

3. Recycled Content: 100 percent.

4. Thickness: 1 inch (25 mm), minimum.

5. Size: 20 by 20 inches (508 by 508 mm), nominal.

6. Size: Minimum 3.3 feet (1 meters) wide rolls.

7. Top Surface: Textured, with rhomboidal indentations.

D. Sod, Fertilizer, and Related Materials: As specified in Section 32 9223 with the following exceptions:

1. Sod Thickness: "Thick" sod, minimum 1 inch (25 mm) and maximum 1-3/8 inch (35 mm) topsoil base.

E. Signs: Provide durable materials suitable for outdoor exposure:

1. Firelane Markings: Identify entrance and physical location of firelanes using signs if gates, curbs, bollards, and other built elements do not adequately indicate firelanes; comply with requirements of local fire authorities.

2. Maintenance Warning Sign: Provide a sign indicating the presence of turf reinforcement, stating that special maintenance is required, with manufacturer's phone number.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subgrade has been prepared correctly, is smooth, and is at the proper grade and level.

B. Do not begin work until subgrade is correct.

3.02 INSTALLATION

A. Install aggregate base course as specified in Section 32 1123.

B. Immediately before installing turf reinforcement, spread moisture absorbent crystals evenly over surface of base course, at rate of 5 pounds per 1000 square feet (2.25 kg per 100 square meters); do not allow crystals to be wetted prior to placement of reinforcement.

C. Install turf reinforcement and fill in accordance with manufacturer’s instructions.

1. Cut units to shape with pruning shears.

2. Place with top of grid/rings flush or slightly below the surface of adjacent hard-surfaced pavements.

3. Anchor units to base course, using anchors recommended by manufacturer, wherever anchorage is necessary to prevent movement by traffic.

D. Sodding: Install sod as specified in Section 32 9223 and as follows:

1. Install sod directly over turf reinforcement units with very tight joints between sod strips.
2. Vibrate sod into reinforcement with roller or plate, with sod in a moist condition, until the bottom of sod touches base of unit.
3. Keep sodded areas fertilized and moist for minimum of 3 weeks.

3.03 CLEANING

A. Clean adjacent paved surfaces of excess sand, gravel, soil, and debris. Sweep broom clean.

3.04 PROTECTION

A. Protect turf from all traffic other than emergency vehicles for minimum of 4 weeks, or until the root system has penetrated and established grass well below the turf reinforcement units.

END OF SECTION

SECTION 32 1216
ASPHALT PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aggregate base course.

B. Single course bituminous concrete paving.

C. Double course bituminous concrete paving.

D. Surface sealer.

1.02 RELATED REQUIREMENTS

A. Section 09 9113 - Exterior Painting: Pavement markings.

B. Section 31 2200 - Grading: Preparation of site for paving and base.

C. Section 31 2323 - Fill: Compacted subgrade for paving.

D. Section 32 1313 - Concrete Paving: Concrete substrate.

E. Section 32 1313 - Concrete Paving: Concrete curbs.

F. Section 32 1413 - Precast Concrete Unit Paving.

G. Section 32 1416 - Brick Unit Paving.

H. Section 32 1440 - Stone Paving.

I. Section 32 1723.13 - Painted Pavement Markings: Concrete bumpers.

J. Section 33 0513 - Manholes and Structures: Manholes, including frames; gutter drainage grilles, covers, and frames for placement by this section.

1.03 REFERENCE STANDARDS

A. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses 2017.

B. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types 2015.

C. AI MS-19 - A Basic Asphalt Emulsion Manual Fourth Edition.

D. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates 2014.

E. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction 2009a.

F. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) 2011.

G. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils 2017.

1.04 PERFORMANCE REQUIREMENTS

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with State of Maryland Highways standard.

B. Mixing Plant: Conform to State of Maryland Highways standard.

C. Obtain materials from same source throughout.

1.06 FIELD CONDITIONS

A. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F (4 degrees C), or surface is wet or frozen.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Conform to applicable code for paving work on public property.

2.02 MATERIALS

A. Aggregate for Base Course: In accordance with State of Maryland Highways standards.

B. Aggregate for Binder Course: In accordance with State of Maryland Highways standards.

C. Aggregate for Wearing Course: In accordance with State of Maryland Highways standards.

D. Fine Aggregate: In accordance with State of Maryland Highways standards.

E. Mineral Filler: Finely ground particles of limestone, hydrated lime or other mineral dust, free of foreign matter.

F. Fiber Reinforcement: Synthetic fibers shown to have long-term resistance to deterioration when in contact with alkalis and moisture; 1/2 inch (12 mm) length.

G. Primer: In accordance with State of Maryland Highways standards.

H. Tack Coat: Homogeneous, medium curing, liquid asphalt.

I. Seal Coat: AI MS-19, sand type.

2.03 ASPHALT PAVING MIXES AND MIX DESIGN

A. Base Course: 3.0 to 6 percent of asphalt cement by weight in mixture in accordance with AI MS-2.

B. Binder Course: 4.5 to 6 percent of asphalt cement by weight in mixture in accordance with AI MS-2.

C. Wearing Course: 5 to 7 percent of asphalt cement by weight in mixture in accordance with AI MS-2.

D. Submit proposed mix design of each class of mix for review prior to beginning of work.

2.04 SOURCE QUALITY CONTROL

A. Test mix design and samples in accordance with AI MS-2.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that compacted subgrade is dry and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

3.02 BASE COURSE

A. Place and compact base course.

3.03 PREPARATION - PRIMER

A. Apply primer in accordance with manufacturer's instructions.

B. Apply primer on aggregate base or subbase at uniform rate of 1/3 gal/sq yd (1.5 L/sq m).

C. Use clean sand to blot excess primer.

3.04 PREPARATION - TACK COAT

A. Apply tack coat in accordance with manufacturer's instructions.

B. Apply tack coat on asphalt or concrete surfaces over subgrade surface at uniform rate of 1/3 gal/sq yd (1.5 L/sq m).

3.05 PLACING ASPHALT PAVEMENT - SINGLE COURSE

A. Install Work in accordance with State of Maryland Highways standards.

B. Place asphalt within 24 hours of applying primer or tack coat.

C. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

D. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

3.06 PLACING ASPHALT PAVEMENT - DOUBLE COURSE

A. Place asphalt binder course within 24 hours of applying primer or tack coat.

B. Place wearing course within two hours of placing and compacting binder course.

C. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

D. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.07 SEAL COAT

A. Apply seal coat to surface course and asphalt curbs in accordance with AI MS-19.

3.08 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch (6 mm) measured with 10 foot (3 m) straight edge.

B. Variation from True Elevation: Within 1/2 inch (12 mm).

3.09 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for quality control.

B. Provide field inspection and testing. Take samples and perform tests in accordance with AI MS-2.

3.10 PROTECTION

A. Immediately after placement, protect pavement from mechanical injury for three days or until surface temperature is less than 140 degrees F (60 degrees C).

3.11 SCHEDULE

A. Pavement at Truck Ramp and Garbage Area: Single course of 3-1/2 inch (89 mm) compacted thickness, sand seal coat.

B. Pavement at Parking Areas: Two courses; binder course of 2-1/2 inch (63 mm) compacted thickness and wearing course of 1 inch compacted thickness, fog seal coat.

C. Pavement at Rear Bus Loading Area: Thickness and compaction of subbase to support vehicles up to 30,000 lb (13 600 kg).

D. Pavement Front Sidewalks: Thickness and compaction of subbase to support moderate pedestrian traffic.

END OF SECTION

SECTION 32 1218
PERVIOUS PAVEMENTS

PART 1 - GENERAL:

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, Specification Sections apply to work in this section.

1.02 DESCRIPTION OF WORK:

A. This work shall consist of constructing pervious pavements consisting of pervious Portland cement concrete mix (rigid pavement) for sidewalk as specified in the Contract Drawings or as directed by the Engineer.

1.03 RELATED WORK:

A. Refer to Section 31 20 00 "Earthmoving".

1.04 STANDARDS:

A. Maryland Department of Transportation State Highway Administration's current "Standard Specifications for Construction and Materials".

B. American Concrete Institute Standard – 522.1 (latest edition)

1.05 SUBMITTALS:

A. Submit location of product manufacture and of extraction/recovery of primary raw materials.

B. Contractor Qualifications related to construction of pervious concrete pavement. The contractor shall furnish the architect with a statement attesting to qualification and experience in placing pervious concrete. The forwarded information shall include the names and addresses of at lest two (2) completed projects.

C. Proposed concrete mixture proportions and density.

D. Submit certificates stating that in-place surface concrete materials achieve a minimum Solar Reflectance Index value of at least 29 when freshly installed, and will achieve a minimum Solar Reflectance Index of at least 29 when weathered, as tested by ASTM C1549.

1.06 QUALITY ASSURANCE:

A. Contractor Qualifications: The Contractor shall employ no less than one National Ready Mixed Concrete Association (NRMCA) certified pervious concrete craftsman who must be on-site, overseeing each placement crew during all concrete placement, or the Contractor shall employ no less than three NRMCA certified Pervious Concrete Installers, who shall be on-site working as members of each placement crew during all concrete placement, or the Contractor shall employ no less than five NRMCA certified Pervious Concrete Technicians, who shall be on site working as members of each placement crew during all concrete placement unless otherwise specified. Alternative documentation of qualifications shall be permitted when approved by the Architect/Engineer.

B. Test Panels: The Contractor is to place, joint, and cure one test panels, each to be a minimum of 225 sq. ft. at the required project thickness. Test panels, if acceptable, may be incorporated into the project. Following a minimum of seven days, two cores shall be extracted from each test panel. The extracted cores shall be tested for thickness in accordance with ASTM C 42; core unit weight in accordance with ASTM C 140, Paragraph 6.3.l, and void structure. Satisfactory performance of the test panels will be determined by:

1. Compacted thickness to be no less than ½” of the specified thickness,

2. Unit weight to be ± five (5) pcf of the design unit weight as approved by the Engineer, and consistency and uniformity of the void structure.
3. Failure to comply with any of the above criteria will result in the Contractor removing and disposing of the test panel at its own expense.
4. The test panel must provide a minimum SRI value of 29 as tested by ASTM C1549. If the test panel fails to meet this requirement provide additional color to the concrete to meet this requirement.

1.07 PROJECT CONDITIONS:

A. Traffic: Maintain pedestrian traffic during walk construction operations.

B. Limitations:

1. Underground Utilities: Do not proceed with concrete construction until underground utility construction is complete.
2. Curbing: Do not proceed with concrete walk construction until adjacent or adjoining curb construction is complete.
3. Handicapped ramps shall be regular concrete, constructed in accordance with Section 32 13 13.

PART 2 - PRODUCTS:

2.01 MATERIALS:

A. Gravel Base: Washed AASHTO No. 3 Coarse Aggregate shall be used as a pavement aggregate base. Washed AASHTO No. 57 stone (same as MSHA Agg. No. 57 Stone, table 901A) shall be used as a Chocker Aggregate Coarse to be placed on top of the pavement aggregate base. Other aggregate sizes may be used if approved by the Engineers. Fine Aggregate shall not be used in either the aggregate base or the chocker aggregate coarse.

AASH												
TO							3/8				#10	#20
No.	2½”	2”	1½”	1”	¾”	½”	”	#4	#8	#16	0	0
3	100	90-100	35-70	0-15		0-5						
57			100	95-100		25-60		0-10	0-5			

a. Regional Materials: Provide aggregate manufactured and of primary raw materials extracted or recovered within 500 mile radius of Project Site.

B. Pervious Portland Cement Concrete: The permeable pavement section shall consist of portland-cement based pervious concrete. Pervious concrete shall be designed and constructed in accordance with ACI 522.1-08 “Specification for Pervious Concrete Pavement”. It is also recommended that the guidelines for Ready-Mixed Concrete, ASTM C94, be used as a general guideline for the manufacturing and delivery of the pervious concrete. Each locality will generally create a unique mix design that will contain locally available materials. It is the responsibility of the Contractor to work with the local Ready-Mix suppliers to finalize a mixdesign that will be acceptable for each project. If the mix-design is new to the local supplier, then at least three trial-batches shall be made before the decision is made to use that particular mix design. Both the Contractor, and the Supplier, must agree on any particular mix design before it is submitted to the Owner's Representative.

Mix Properties	Targeted Criteria	Tolerance of Mix Design
Cementitious Materials* (MDOT-SHA 902-03)	650 lb/yd3	± 50 lb

Water Cement Ratio*	0.30	± 0.03
Design Unit Weight* (ASTM) C 29 Paragraph 11, Jigging Procedure	135 lb/ft3	± 5 lb.
Coarse Aggregate*	AASHTO No 89	-
Fine Aggregate	None	-
Permeability	8”/hr min.	-
Thickness	Per Plan	-
All Voids	22% min.	± 3%

a. * Or as approved by the Engineer

C. Joint Materials: Expansion and Isolation Joints: ASTM D 994, bituminous preformed joint filler, 1/2 inch thick.

D. Forms: Steel or wood for straight or tangent walks. Non-rented wood materials shall be FSC-certified sustainably harvested.

E. Curing Materials: Burlap Mats: AASHTO M182, Class 1.

F. Joint Sealant: Shall conform to MDOT-SHA Standards Section 911.01.

G. Miscellaneous Products:

1. Form Release Compound: Non-staining, zero-VOC, 100% biodegradable made from plant-based oils and approved by the Architect.

2. Cement Mortar: Section 33 10 00 "Utility Standards".

PART 3 - EXECUTION:

3.01 PROTECTION AND RESTORATION:

A. Concrete: Protect completed concrete from damage. Restore damaged concrete as directed by the Owner’s Representative or the Architect.

3.02 SUBGRADE PREPARATION:

A. Paved Areas: Section 31 20 00 "Earthmoving" and as noted. Verify subgrade elevations and compaction and correct discrepancies before proceeding with construction. After reaching the required elevation the exposed subgrade shall not be compacted. Slope of the exposed subgrade shall not exceed 5 percent. Elevation of existing groundwater shall be at least (3) feet below the level of the exposed subgrade. Bedrock, if any, shall be located at least two (2) feet below the level of the exposed subgrade.

B. Geotextile: The exposed subgrade shall be overlaid by an SD TYPE II nonwoven geotextile fabric installed in accordance with manufacturer’s recommendations. The fabric shall be se- cured around the aggregate base for protection against runoffs and flow of sediments.

C. Determine subgrade permeability in accordance with ASTM D3385 before concrete placement. Confirm that subgrade permeability meets requirements of Contract Documents.

3.03 GRAVEL BASE PLACEMENT:

A. Aggregate Base: Thickness of the aggregate base shall not be less than 36 inches or as directed by the Engineer. Do not place gravel base material on frozen or muddy subgrade.

B. Chocker Aggregate Coarse: the choker aggregate coarse, placed on top of the aggregate base, shall provide a level paving plane prior to placing the pervious concrete. Thickness of the choker aggregate coarse shall be a minimum of 2 inches. Remove debris from surface of gravel prior to placement of concrete.

3.04 FORMS:

A. Fixed forms shall be of steel or wood and shall extend to the full depth of the concrete. All forms shall be straight, free from warp and of sufficient strength to resist the pressure of the concrete without displacement. Bracing and staking of forms shall be so that the forms remain in both horizontal and vertical alignment until their removal. The forms shall be thoroughly cleaned and coated with form release compound each time they are used. The concrete shall be set for a minimum of 12 hours before the forms are removed and every precaution shall be taken to avoid damaging the concrete.

3.05 EXPANSION JOINTS:

A. Install expansion joints at maximum 40-foot intervals or as indicated. Install expansion joints, adjacent to curbing, opposite curbing joints, around structures and as indicated. Place expansion joints perpendicular to concrete surface and with top edge 1/2 inch below concrete surface. Provide sealant on all expansion joints.

3.06 ISOLATION JOINTS:

A. Install isolation joints where concrete abuts buildings, existing walk sections, utility structures and concrete curb. Place isolation joints with top edge 1/4 inch below concrete surface.

3.07 CONTRACTION JOINTS (SCORE LINES):

A. Provide contraction joints at 20-foot intervals or as indicated. Form contraction joints with 3/4 inch jointing tool.

3.08 CONCRETE PLACEMENT:

A. Sample Approval: No pervious concrete may be constructed until the sample section has been inspected and approved by the Owner’s Representative.

B. General: Before placing concrete the choker aggregate coarse shall be moistened with water. The concrete shall be mixed in conformance with approved mix design. Concrete shall be deposited on the prepared choker aggregate coarse in successive batches to the full width of the formed section. It shall be struck off, screeded to the elevation of the top of the forms, and rolled to consolidate.

3.09 FINISHING:

A. Plastering of the surface is prohibited. Pervious concrete shall not be floated or troweled. A steel roller shall be used for compaction and finishing. All outside edges and all joints shall be edged with a ¼ in. edging tool.

3.10 CURING:

A. Begin curing within 20 minutes of concrete discharge unless longer working time is accepted by the Architect/Engineer.

B. Completely cover the pavement surface with a minimum 6 mil (0.15 mm) thick polyethylene sheet. Cut sheeting to a minimum of a full placement width.

C. Cover all exposed edges of pavement with polyethylene sheet.

D. Secure curing cover material without using dirt.

E. Cure pavement for a minimum of 7 uninterrupted days, unless otherwise specified.

3.11 JOINT SEALING:

A. Expansion joints shall be cleaned of dirt or other foreign material prior to placement of the joint sealing compound. Joint surfaces to which the sealing material is to adhere shall be surface dry for at least three hours prior to sealing. No sealing material shall be used until the joints are acceptable to the Engineer. The surface of the sealing compound shall be a maximum of 1/8 in. below the level of the sidewalk

surface.

3.12 TESTING:

A. General: Correct work not conforming to tolerances as directed by the Owner's Representative or the Architect, at no increase to the contract sum.

B. Density shall be determined for each 100 cubic yards or fraction thereof delivered, with a minimum of one test for each day's placement. Plastic concrete shall be collected in accordance with ASTM C172. Density shall be determined in accordance with ASTM C138, following the consolidation procedures described in ASTM C1688. The density of the delivered concrete shall be within plus-or-minus 5 pounds per cubic foot of the specified design density.

C. Failure to comply with any of the thickness, unit weight, or voids criteria shall result in the Contractor removing and disposing of the non-complying porous concrete at the Contractor's own expense.

D. Smoothness Tests: Conduct surface smoothness tests. Tolerance not to exceed 1/4 inch between any two surface contacts on a 10-foot straightedge. Test locations are random and to be determined by the Owner's Representative or the Architect. Regardless of paved area size, at least one test shall be performed for each newly paved area.

3.13 BACKFILL

A. After the forms have been stripped and any necessary repairs are satisfactorily completed, the spaces in front and back of the sidewalk shall be backfilled to the required elevations using material approved by the Engineer.

END OF SECTION

SECTION 32 1313
CONCRETE PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete sidewalks, stair steps, integral curbs, gutters, median barriers, parking areas and roads.

1.02 RELATED REQUIREMENTS

A. Section 03 1000 - Concrete Forming and Accessories.

B. Section 03 2000 - Concrete Reinforcing.

C. Section 03 3000 - Cast-in-Place Concrete.

D. Section 07 9200 - Joint Sealants: Sealing joints.

E. Section 09 9113 - Exterior Painting: Pavement markings.

F. Section 31 2200 - Grading: Preparation of site for paving and base and preparation of subsoil at pavement perimeter for planting.

G. Section 31 2323 - Fill: Compacted subbase for paving.

H. Section 32 1123 - Aggregate Base Courses:

I. Section 32 1216 - Asphalt Paving: Asphalt wearing course.

J. Section 32 1413 - Precast Concrete Unit Paving.

K. Section 32 1416 - Brick Unit Paving.

L. Section 32 1440 - Stone Paving.

M. Section 32 1726 - Tactile Warning Surfacing: Plastic tactile and detectable warning tiles for pedestrian walking surfaces.

N. Section 33 0513 - Manholes and Structures: Manholes, including frames; gutter drainage grilles, covers, and frames for placement by this section.

1.03 REFERENCE STANDARDS

A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete 1991 (Reapproved 2009).

B. ACI 301 - Specifications for Structural Concrete 2016.

C. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete 2000 (Reapproved 2009).

D. ACI 305R - Guide to Hot Weather Concreting 2010.

E. ACI 306R - Guide to Cold Weather Concreting 2016.

F. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2018, with Editorial Revision (2018).

G. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2018.

H. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2016, with Editorial Revision (2016).

I. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens 2018.

J. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete 2017a.

K. ASTM C150/C150M - Standard Specification for Portland Cement 2018.

L. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method 2016.

M. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete 2010a (Reapproved 2016).

N. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete 2011.

O. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete 2017.

P. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing 2014.

Q. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types) 2018.

R. ASTM D1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction 2004a (Reapproved 2013).

S. ASTM D8139 - Standard Specification for Semi-Rigid, Closed-Cell Polypropylene Foam, Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction 2017.

1.04 **SUBMITTALS**

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on joint filler, admixtures and curing compound.

C. Design Data: Indicate pavement thickness, designed concrete strength, reinforcement, and typical details.

1.05 **QUALITY ASSURANCE**

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.

PART 2 PRODUCTS

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

C. Work, materials, and color of any handicap ramp paving shall conform to applicable sections of Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities.

D. Paving work, base course etc., shall be done only after excavation and construction work which might damage them have been completed. Damage caused during construction shall be repaired before acceptance.

E. Existing paved areas shall, if damaged or removed during course of this project, be repaired or replaced under this section of the specification. Workmanship and materials for such repair and replacement, except as otherwise noted, shall match as closely as possible those employed in existing work.

F. Pavement, base, or sub-base shall not be placed on a muddy or frozen subgrade.

2.02 **PAVING ASSEMBLIES**

A. Comply with applicable requirements of ACI 301.

B. Design paving for parking and residential streets.

C. Concrete Sidewalks and Median Barrier: 3,000 psi (20.7 MPa) 28 day concrete, 4 inches (100 mm) thick, buff color Portland cement, exposed aggregate finish.

D. Parking Area Pavement: 4,000 psi (27.6 MPa) 28 day concrete, 5 inches (125 mm) thick, 6 by 6 - W2.9 by W2.9 mesh reinforcement, wood float finish.

2.03 FORM MATERIALS

A. Form Materials: As specified in Section 03 1000, conform to ACI 301.

B. Joint Filler: Preformed; non-extruding bituminous type (ASTM D1751) or sponge rubber or cork (ASTM D1752).

1. Thickness: 1/2 inch (12 mm).

2.04 REINFORCEMENT

A. Reinforcing Steel and Welded Wire Reinforcement: Types specified in Section 03 2000.

B. Dowels: ASTM A615/A615M, Grade 40 - 40,000 psi (280 MPa) yield strength; deformed billet steel bars; unfinished finish.

2.05 CONCRETE MATERIALS

A. Concrete Materials: As specified in Section 03 3000.

B. Fiber Reinforcement: Synthetic fibers shown to have long-term resistance to deterioration when in contact with alkalis and moisture; 1/2 inch (12 mm) length.

2.06 ACCESSORIES

A. Acid Etch Solution: Muriatic type mixed to a 10 percent solution.

B. Curing Compound: ASTM C309, Type 1, Class A.

C. Liquid Surface Sealer:

D. Surface Retarder:

1. Color: As indicated.

E. Slab Isolation Joint Filler: 1/2 inch (13 mm) thick, height equal to slab thickness, with removable top section that will form 1/2 inch (13 mm) deep sealant pocket after removal.

1. Material: ASTM D1751, cellulose fiber.

F. Tactile Warning Surfaces: See Section 32 1726.

2.07 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.

1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer.

D. Fiber Reinforcement: Add to mix at rate of 1.5 pounds per cubic yard (0.89 kg per cubic meter), or as recommended by manufacturer for specific project conditions.

E. Concrete Properties:

1. Compressive strength, when tested in accordance with ASTM C39/C39M at 28 days; .

2. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
3. Calcined Pozzolan Content: Maximum 10 percent of cementitious materials by weight.
4. Silica Fume Content: Maximum 5 percent of cementitious materials by weight.
5. Water-Cement Ratio: Maximum 40 percent by weight.
6. Total Air Content: 4 percent, determined in accordance with ASTM C173/C173M.
7. Maximum Slump: 3 inches (75 mm).

2.08 **MIXING**

A. On Project Site: Mix in drum type batch mixer, complying with ASTM C685/C685M. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.

B. Transit Mixers: Comply with ASTM C94/C94M.

PART 3 EXECUTION

3.01 **EXAMINATION**

A. Verify compacted subgrade is acceptable and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

3.02 **SUBBASE**

A. See Section 32 1123 for construction of base course for work of this Section.

3.03 **PREPARATION**

A. Moisten base to minimize absorption of water from fresh concrete.

B. Coat surfaces of manhole frames with oil to prevent bond with concrete pavement.

C. Notify Architect minimum 24 hours prior to commencement of concreting operations.

3.04 **FORMING**

A. Place and secure forms to correct location, dimension, profile, and gradient.

B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.05 **REINFORCEMENT**

A. Place reinforcement at top of slabs-on-grade.

B. Interrupt reinforcement at contraction joints.

C. Place dowels to achieve pavement and curb alignment as detailed.

3.06 **COLD AND HOT WEATHER CONCRETING**

A. Follow recommendations of ACI 305R when concreting during hot weather.

B. Follow recommendations of ACI 306R when concreting during cold weather.

C. Do not place concrete when base surface temperature is less than 40 degrees F (4 degrees C), or surface is wet or frozen.

3.07 **PLACING CONCRETE**

A. Place concrete in accordance with ACI 304R.

B. Do not place concrete when base surface is wet.

C. Ensure reinforcement, inserts, embedded parts, formed joints and [____] are not disturbed during concrete placement.

D. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

E. Apply surface retarder to all exposed surfaces in accordance with manufacturer's instructions.

3.08 **JOINTS**

A. Align curb, gutter, and sidewalk joints.

B. Place 3/8 inch (10 mm) wide expansion joints at 20 foot (6 m) intervals and to separate paving from vertical surfaces and other components and in pattern indicated.

1. Form joints with joint filler extending from bottom of pavement to within 1/2 inch (13 mm) of finished surface.

2. Secure to resist movement by wet concrete.

C. Provide scored joints.

1. At 3 feet (1 m) intervals.

2. Between sidewalks and curbs.

3. Between curbs and pavement.

D. Provide keyed joints as indicated.

E. Saw cut contraction joints 3/16 inch (5 mm) wide at an optimum time after finishing. Cut 1/3 into depth of slab.

3.09 **FINISHING**

A. Sidewalk Paving: Light broom, texture perpendicular to direction of travel with troweled and radiused edge 1/4 inch radius (6 mm radius).

B. Curbs and Gutters: Light broom, texture parallel to pavement direction.

C. Place sealer on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

3.10 **TOLERANCES**

A. Maximum Variation of Surface Flatness: 1/4 inch (6 mm) in 10 ft (3 m).

B. Maximum Variation From True Position: 1/4 inch (6 mm).

3.11 **FIELD QUALITY CONTROL**

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.

1. Provide free access to concrete operations at project site and cooperate with appointed firm.

2. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.

3. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.

B. Compressive Strength Tests: ASTM C39/C39M; for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cu yd (76 cu m) or less of each class of concrete placed.

1. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
2. Perform one slump test for each set of test cylinders taken.

C. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.12 **PROTECTION**

A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

B. Do not permit pedestrian traffic over pavement until 75 percent design strength of concrete has been achieved.

END OF SECTION

SECTION 32 1413
PRECAST CONCRETE UNIT PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interlocking concrete paver units.

B. Non-interlocking concrete paver units.

C. Open grid concrete paver units.

D. Detectable warning pavers.

E. Sand setting bed.

F. Sand joint filler.

G. Polymeric sand joint filler.

H. Aggregate fill.

I. Topsoil filler.

J. Edge restraints.

1.02 RELATED REQUIREMENTS

A. Section 31 2200 - Grading: Preparation of subsoil for pavers.

B. Section 31 2323 - Fill: Compacted fill for pavers.

C. Section 32 1123 - Aggregate Base Courses: Aggregate subbase for pavers.

D. Section 32 1216 - Asphalt Paving: Pavement subbase for pavers.

E. Section 32 1313 - Concrete Paving: Concrete subbase for pavers.

F. Section 33 0513 - Manholes and Structures: Manholes including frames.

1.03 REFERENCE STANDARDS

A. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2016, with Editorial Revision (2016).

B. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar 2017.

C. ASTM C936/C936M - Standard Specification for Solid Concrete Interlocking Paving Units 2018.

D. ASTM C1319 - Standard Specification for Concrete Grid Paving Units 2017.

E. ASTM D5268 - Standard Specification for Topsoil Used for Landscaping Purposes 2013.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide characteristics of paver unit, detectable warning pavers, dimensions, and special shapes.

C. Product Data: Provide characteristics of polymeric sand, including base material, additive(s), compressive strength, and color.

D. Samples: Submit two samples of each paver type, illustrating style, size, color range and surface texture of units being provided.

E. Manufacturer's Installation Instructions: Indicate substrate requirements and installation methods.

F. Maintenance Materials: Provide the following for Owner 's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Pavers: 10 of each type and size.

1.05 QUALITY ASSURANCE

A. Paving Subcontractor Qualifications:

1. Utilize an installer having successfully completed concrete paver installation similar in design, material, and extent indicated on this project.
2. Utilize an installer holding a current certificate from the Interlocking Concrete Pavement Institute Concrete Paver Installer Certification program.

B. Regulatory Requirements and Approvals: All applicable licensing, bonding or other requirements of Prince George's County.

C. Mock-ups:

1. Install a 4 ft x 4 ft paver area.
2. Use this area to determine surcharge of the bedding sand layer, joint sizes, lines, laying pattern(s), color(s) and texture of the job.
3. This area will be used as the standard by which the work will be judged.
4. Subject to acceptance by owner, mock-up may be retained as part of finished work.
5. If mock-up is not retained, remove and properly dispose of mock-up.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Interlocking Permeable Concrete Pavers:

1. Capitol Ornamental Concrete Specialties, Inc: www.capitolconcreteproducts.com/#sle.
2. Hanover Architectural Products, Inc: www.hanoverpavers.com/#sle.
3. Oldcastle: www.oldcastle.com/#sle.
4. Tectura Designs, a division of Wausau Tile Inc; Granitex: www.tecturadesigns.com/#sle.
5. The Concrete Products Group; Spec-Pave: www.concreteproductsgroup.com/#sle.
6. Unilock; Promenade Plank Pavers: www.unilock.com/#sle.
7. Substitutions: See Section 01 6000 - Product Requirements.

B. Open Grid Concrete Pavers:

1. Belgard Turfstone: www.belgard.biz/dealer.htm.
2. Interlock Paving Systems, Inc www.interlockonline.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Interlocking Concrete Pavers: Hydraulically pressed concrete, configured for interlocking with adjacent units and complying with ASTM C936/C936M.

1. Compressive Strength: 8000 pounds per square inch (55 MPa) average, with minimum of 7200 pounds per square inch (50 MPa).
2. Thickness: 2-3/8 inches (60 mm).
3. Type: Rectangular.

4. Color: Natural.

B. Open Grid Pavers: Precast concrete units complying with ASTM C1319.

1. Compressive Strength: 5000 pounds per square inch (35 MPa) average, with minimum of 4500 pounds per square inch (31 MPa).
2. Absorption: Maximum of 10 pounds per cubic foot (160 kg per cubic m) averaged over three units.
3. Net Open Area: Minimum 50 percent.
4. Thickness: 3-1/8 inches (80 mm).
5. Color: Natural.

C. Detectable Warning Pavers: Cast concrete with truncated domes, color provided by architect.

D. Sand for Setting Bed: Clean washed natural sand or crushed stone complying with gradation requirements of ASTM C33/C33M for fine aggregates.

E. Sand for Joints: Fine washed sand with 100 percent passing No. 16 (1.18 mm) sieve and not more than 10 percent passing No. 200 (0.075 mm) sieve.

F. Polymeric Sand: Fine sand conforming to ASTM C144 combined with polymer binders for creating semi-solid joints between pavers.

1. Material: Granite.
2. Additive(s): Portland Cement.
3. Compressive Strength: 750 pounds per square inch (5 MPa).
4. Adhesion by Tensile Load: 100 pounds per square inch (0.7 MPa).
5. Color: Beige.

G. Aggregate Fill: Open-graded aggregate for filling voids and joints in open grid paver units, conforming to requirements of ASTM C33/C33M for No. 8 crushed stone.

H. Topsoil Fill: For filling voids and joints, provide topsoil conforming to ASTM D5268.

I. Edging: Concrete curb, as detailed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate is level or to correct gradient, smooth, capable of supporting pavers and imposed loads, and ready to receive work of this Section.

B. Verify gradients and elevations of substrate are correct.

C. Verify dry weather forecast without rain for a minimum of 24 hours with temperatures above 55 degrees Fahrenheit (13 degrees Celsius).

D. Verify that pavers are completely dry prior to polymeric sand installation.

3.02 PREPARATION

A. Treat soil with herbicide to retard plant growth.

B. Wear clothing and equipment to protect from excessive exposure to polymeric sand.

C. See Section 31 2200 for subsoil preparation.

D. See Section 31 2323 for fill compaction requirements.

E. See Section 32 1123 for aggregate subbase.

F. See Section 32 1216 for pavement subbase.

G. See Section 32 1313 for concrete subbase.

3.03 INSTALLATION OF SOLID PAVER UNITS

A. Spread sand bedding evenly over prepared substrate surface to a maximum thickness of 1-1/2 inch (38 mm).

B. Dampen and roller compact sand to level and even surface.

C. Screed and scarify top 1 inch to 1 1/2 inch (12 mm) of sand.

D. Cut paver units at edges with masonry saw.

E. Place half units at edge and interruptions. Maintain tight joints.

F. Sprinkle sand over surface and sweep into joints. Moisten joints and recover with additional sand until firm joints are achieved. Remove excess sand.

G. Spread polymeric sand uniformly over surface. Use a push broom to fill joints and remove excess while not sweeping long distances. Sweep all excess with a fine bristle brush and remove residues with a leaf blower.

H. Tamp and level paver units with mechanical vibrator until units are firmly bedded, level, and to correct elevation and gradients. Do not tamp unrestrained edges.

3.04 INSTALLATION OF OPEN GRID PAVER UNITS

A. Spread sand evenly over prepared substrate course and screed to a uniform thickness of 1-1/2 inch (38 mm).

B. Place paver units in pattern indicated on drawings.

C. Maintain uniform joints between paver units not more than 1/8 inch (4 mm) wide.

D. Cut paver units at edges with masonry saw.

E. Compact and seat paver units into screeded setting bed using low amplitude plate compactor capable of at least 5,000 lb (22 kN) centrifugal compaction force.

F. Vibrate and compact pavers again while sweeping aggregate fill or topsoil into joints and openings in pavers, stopping when fill material is within 1/2 inch (13 mm) from top surface of units. Do not compact within 3 ft (1 m) of unrestrained paver edges.

G. Completely fill voids in pavers with aggregate fill. Remove excess material.

3.05 CLEANING

A. Do not clean pavers until pavers and mortar are dry.

B. Clean soiled surfaces using cleaning solution. Do not harm pavers, joint materials, or adjacent surfaces.

C. Use non-metallic tools in cleaning operations.

D. Rinse surfaces with clean water.

E. Broom clean paving surfaces. Dispose of excess sand.

F. See Section 01 7419 for construction waste management and disposal.

3.06 PROTECTION

A. Do not permit traffic over unprotected paver surface.

B. Protect paver surface with sheets of plywood.

C. Do not permit traffic for 48 hours after pavement placement.

3.07 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide a separate maintenance contract for specified maintenance service.

END OF SECTION

SECTION 32 1416
BRICK UNIT PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Brick Pavers.

B. Sand Materials.

C. Cementitious Materials.

D. Bituminous Materials.

E. Reinforcement.

F. Accessories.

G. Mixes.

1.02 RELATED REQUIREMENTS

A. Section 31 2323 - Fill: Compacted subbase preparation.

B. Section 32 1216 - Asphalt Paving: Bituminous paving for brick paver base; extruded asphalt curbs.

C. Section 32 1313 - Concrete Paving: Concrete paving for brick paver base; concrete curbs.

D. Section 33 0513 - Manholes and Structures: Frames to be built into paving.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

B. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2018.

C. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2016, with Editorial Revision (2016).

D. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar 2017.

E. ASTM C150/C150M - Standard Specification for Portland Cement 2018.

F. ASTM C270 - Standard Specification for Mortar for Unit Masonry 2014a.

G. ASTM C902 - Standard Specification for Pedestrian and Light Traffic Paving Brick 2015.

H. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.

I. ASTM C1272 - Standard Specification for Heavy Vehicular Paving Brick 2017.

J. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants 2018.

K. ASTM D946/D946M - Standard Specification for Penetration-Graded Asphalt Binder for Use in Pavement Construction 2015.

L. ASTM D1073 - Standard Specification for Fine Aggregate for Asphalt Paving Mixtures 2016.

M. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types) 2018.

N. ASTM D1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction 2004a (Reapproved 2013).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittals procedures.

B. Product Data: Provide data on characteristics of paver unit, curbs and border, special shapes, dimensions, setting and grouting materials.

C. Product Data: Provide characteristics of polymeric sand, including base material, additive(s), compressive strength, and color.

D. Shop Drawings: Indicate on shop drawings, layout of pavers, special design layout, layout of curbs and borders, dimensions of paved areas, control jointing, elevations, and affected adjacent construction.

E. Samples: Submit two sample paver, curb, and border units illustrating color, surface finish, and texture.

F. Maintenance Materials: Provide the following for Owner 's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

2. Extra Pavers: 10 of each type and size.

1.05 QUALITY ASSURANCE

A. Paver Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with Five years experience.

1.06 MOCK-UP

A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.

B. Size: 100 sq ft (10 sq m).

C. Install setting bed, brick pavers, curbs and border, and accessories to pattern indicated.

1. Show range of shades, color, and texture of pavers.

D. Mock-up may remain as part of the Work.

1.07 FIELD CONDITIONS

A. Do not install mortar when surrounding air or substrate surface temperature is below 50 degrees F (10 degrees C) prior to, during, and 48 hours after completion of work.

B. Do not install mortar when surrounding air or substrate surface temperature is above 90 degrees F (32 degrees C) during and 48 hours after completion of the work.

C. Do not install mortar when wind velocity exceeds 15 mph (24 kph) or relative humidity exceeds 50 percent.

D. At end of working day, or during rainy weather, cover work exposed to weather with waterproof coverings, securely anchored.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Brick Pavers:

1. Belden Brick; City Line Extruded Pavers: www.beldenbrick.com/#sle.

2. Endicott Clay Products Co; Pedestrian/Light Duty Vehicular Pavers: www.endicott.com/#sle.

3. General Shale Brick: www.generalshale.com/#sle.

4. Glen-Gery Corp: www.glengerybrick.com/#sle.

5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 APPLICATIONS

A. Sidewalks and Residential Driveways: Pavers for pedestrian traffic.
   1. Setting Bed: Sand, with open joints.
   2. Subbase: See drawings.
B. Roads, Streets, Service Drives, and Parking Lots: Pavers for vehicular traffic.
   1. Setting Bed: Mortar setting bed, mortar joints.
   2. Subbase: See drawings.

2.03 BRICK PAVERS

A. Pavers for Pedestrian Traffic: Extruded fire clay.
   1. Grade: ASTM C902 Weather Class SX Traffic Type I, with dimensional tolerances complying with Application PS.
   2. Face Size: 4 by 8 inches (102 by 204 mm).
   3. Thickness: 1-1/4 inches (32 mm).
   4. Exposed Surface Texture: Wirecut.
   5. Edges: Square.
   6. Lugged Pavers: 1/8 inch (3 mm) lugs within nominal face size.
   7. Handicapped Detectable Warning Pavers: Molded with ADA Standards compliant bumps; matching other pavers.
   8. Stair Tread/Nosing: Bullnose leading edge.
   9. Color: As selected by Architect from manufacturer's standard colors.
   10. Manufacturers:
      a. Endicott Clay Products Co; Pedestrian/Light Duty Vehicular Pavers: www.endicott.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.
B. Pavers For Vehicular Traffic: Extruded fire clay.
   1. Grade: ASTM C1272, Type R, dimensional tolerances conforming to Application PS.
   2. Face Size: 4 by 8 inches (102 by 204 mm).
   3. Thickness: 2-5/8 inches (67 mm).
   4. Exposed Surface Texture: Wirecut.
   5. Edges: Square.
   6. Lugged Pavers: 1/8 inch (3 mm) lugs within nominal face size.
   7. Color: As selected by Architect from manufacturer's standard colors.

2.04 SAND MATERIALS

A. Sand for Base and Joint Filler: ASTM C33/C33M, clean, washed river or bank sand containing maximum of 50 percent particle size of No. 50 (300 micro m) sieve.
B. Polymeric Sand: Fine sand conforming to ASTM C144 combined with polymer binders for creating semi-solid joints between pavers.
   1. Material: Granite.
   2. Additive(s): Portland Cement.

3. Compressive Strength: 750 pounds per square inch (5 MPa).
4. Adhesion by Tensile Load: 100 pounds per square inch (0.7 MPa).
5. Color: Beige.

2.05 CEMENTITIOUS MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I; white color.

B. Sand: ASTM C33/C33M, sharp, clean, screened sand free from deleterious material.

C. Premixed Grout Mortar:

D. Water: Potable and not detrimental to mortar.

E. Admixtures: Air entrainment to achieve 5 to 7 percent.

2.06 BITUMINOUS MATERIALS

A. Asphalt Cement: Conform to ASTM D946.

B. Fine Aggregate: Sand conforming to ASTM D1073, sharp, clean, free from deleterious material.

2.07 REINFORCEMENT

A. Welded Wire Reinforcement: ASTM A1064/A1064M; 2 x 2, 16/16 wire (50 x 50, 1.5/1.5 wire); galvanized steel.

2.08 ACCESSORIES

A. Separation Sheet: No. 15 asphalt roofing felt.

B. Cleaning Solution: Type recommended by paver manufacturer.

C. Mortar Bed Joint Filler: Preformed compressible strip complying with ASTM D1751 or ASTM D1752, or closed-cell non-absorbent compressible polyethylene or polymer foam in sheet form; thickness as required to form joint of indicated width; intended to remain in joint to allow moderate movement.

D. Sealant: ASTM C920, self-leveling or nonsag polyurethane or silyl-terminated polyether/polyurethane (STPE/STPU) sealant approved by manufacturer for traffic exposure without being recessed below the top of substrate surface.

1. Color: Concrete gray.

E. Backer Rod: ASTM C1330, closed-cell polyethylene, 25 to 33 percent larger in diameter than joint width.

F. Neoprene Modified Asphalt Adhesive: 2 percent neoprene in oxidized asphalt, 10 percent long fibered inert reinforcement material.

G. Sealer: Acrylic topcoat.

H. Sealer: Penetrating.

2.09 MIXES

A. Cementitious Bed: Portland cement mix conforming to the following:

1. Compressive Strength (28 day): 2000 psi (15 MPa).
2. Slump: 3 to 4 inches (75 to 100 mm).
3. Air Entrained: 5 to 7 percent.

B. Joint Mortar: ASTM C270, Type M, using the Proportion Specification.

C. Add admixtures in accordance with manufacturer's instructions.

D. Thoroughly mix ingredients in quantities required for immediate use.

E. Use within two hours after mixing. Do not re-temper thereafter.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify substrate is ready to support pavers and imposed loads.

B. Verify gradients and elevations of substrate are correct.

C. Verify dry weather forecast without rain for a minimum of 24 hours with temperatures above 55 degrees Fahrenheit (13 degrees Celsius).

D. Verify that pavers are completely dry prior to polymeric sand installation.

3.02 PREPARATION

A. See Section 31 2323 for subbase preparation.

B. See Section 32 1216 for pavement subbase.

C. See Section 32 1313 for concrete subbase.

D. See Section 33 0513 for manholdes and structures.

3.03 INSTALLATION - MORTAR SETTING BED

A. Locate control and expansion joints directly above joints in structural base and where indicated on drawings; use joint filler to form full depth joint before laying mortar bed.

1. Control Joints: 1/2 inch (13 mm) wide.

2. Expansion Joints: 1/2 inch (13 mm) wide.

B. Place a full cementitious mortar bed of minimum 1 inch (25 mm) thickness over entire paver area.

C. Place reinforcement at mid-height of bed thickness.

D. Place paver units in herringbone pattern to match existing, from straight reference line.

E. Place half units or special shaped units at edges and interruptions. Machine saw partial units.

F. Maintain uniform joint width of 3/8 inch (9 mm) between pavers, and at abutting vertical surfaces and protrusions.

G. Keep control and expansion joints free of mortar, for sealant installation.

H. Fill joints with mortar; pack and work into voids; neatly tool surface to concave joint.

I. Seal control and expansion joints with sealant, in accordance with sealant manufacturer's instructions; use joint filler, backer rod, and or bond breaker tape to achieve width-to-depth ratio recommended by sealant manufacturer.

3.04 INSTALLATION - OVER CONCRETE PAVING

A. Sweep substrate surface clean of loose matter.

B. Place separation sheet over paved surfaces in one layer. Butt edges and ends; do not lap.

C. Place paver units in herringbone pattern to match existing, from straight reference line.

D. Sprinkle sand over surface and sweep into joints. Moisten joints and recover with additional sand until firm joints are achieved. Remove excess sand.

3.05 CLEANING

A. Do not clean pavers until pavers and mortar are dry.

B. Clean soiled surfaces using cleaning solution. Do not harm pavers, joint materials, or adjacent surfaces.

C. Use non-metallic tools in cleaning operations.

D. Rinse surfaces with clean water.

E. Broom clean paving surfaces. Dispose of excess sand.

F. See Section 01 7419 for construction waste management and disposal.

3.06 PROTECTION

A. Do not permit traffic over unprotected paver surface.

B. Protect paver surface with sheets of plywood.

C. Do not permit traffic for 48 hours after pavement placement.

3.07 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide a separate maintenance contract for specified maintenance service.

END OF SECTION

SECTION 32 1440
STONE PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Paver materials.

B. Sand bed materials.

C. Mortar and grout materials.

D. Accessories.

E. Mixes.

1.02 RELATED REQUIREMENTS

A. Section 31 2200 - Grading: Preparation of subsoil for pavers.

B. Section 31 2323 - Fill: Compacted fill for pavers.

C. Section 32 1216 - Asphalt Paving: Subbase for pavers.

D. Section 32 1313 - Concrete Paving: Subbase for pavers.

E. Section 33 0513 - Manholes and Structures: Frames to be built into paving.

1.03 REFERENCE STANDARDS

A. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2018.

B. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2016, with Editorial Revision (2016).

C. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar 2017.

D. ASTM C150/C150M - Standard Specification for Portland Cement 2018.

E. ASTM C270 - Standard Specification for Mortar for Unit Masonry 2014a.

F. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.

G. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants 2018.

H. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types) 2018.

I. ASTM D1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction 2004a (Reapproved 2013).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide characteristics of paver unit, dimensions, special shapes, and setting materials.

C. Product Data: Provide characteristics of polymeric sand, including base material, additive(s), compressive strength, and color.

D. Shop Drawings: Indicate layout of pavers and curbs, dimensions of paved areas, elevations, and affected adjacent construction.

E. Samples: Submit two samples of each paver and curb size, illustrating style, size, color range and surface texture of units being provided.

F. Manufacturer's Installation Instructions: Indicate substrate requirements , and installation methods.

G. Maintenance Materials: Provide the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

2. Extra Pavers: 10 of each type and size.

1.05 QUALITY ASSURANCE

A. Installer Qualifications:

1. Engage experienced installer that has completed stone installation similar in material, design, and extent to that indicated for the project.

2. Installer shall have a minimum 5 years experience with similar materials and shall have a record of successful projects of comparable size.

B. Fabricator Qualifications: Engage experienced fabricator that has completed stone fabrication similar in material, design, and extent to that indicated for the project.

C. Source Limitations for Stone: Obtain each stone variety from a single quarry.

1. Make quarried blocks available for examination by Architect.

1.06 MOCK-UP

A. Provide paver mock-up, 4 feet (1.2 m) long by 4 feet (1.2 m) wide; include setting bed, pavers, curbs, joints, and edging.

B. Locate where directed.

C. Mock-up may not remain as part of the Work.

1.07 FIELD CONDITIONS

A. Maintain cementitious materials and substrate surface to a minimum of 50 degrees F (10 degrees C) prior to, during, and 48 hours after completion of work.

B. At end of working day or during rainy weather, cover work exposed to weather with waterproof coverings, securely anchored.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Granite Pavers:

1. Cold Spring Granite Inc: www.coldspringgranite.com/#sle.

2. Fletcher Granite Company, Inc: www.fletchergranite.com/#sle.

3. North Carolina Granite Corporation: www.ncgranite.com/#sle.

4. Substitutions: See Section 01 6000 - Product Requirements.

B. Slate Pavers:

1. Echeguren Slate, Inc: www.echeguren.com/#sle.

2. Hilltop Slate, Inc: www.hilltopslate.com/#sle.

3. Structural Slate Company: www.structuralslate.com/#sle.

4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAVER MATERIALS

A. Granite Pavers: Dimension stone units; size, thick; shape, surface finish; color selected from quarried range and to be determined by Owner.

B. Slate Pavers: Split units with sawn backs; size, thick; shape, surface finish; color selected from quarried range available and to be determined by Owner..

2.03 SAND BED MATERIALS

A. Sand for Base: Clean washed bank sand containing maximum of 30 percent particle size of No. 10 (2 mm) sieve.

B. Sand for Joints: Clean washed fine sand.

C. Polymeric Sand: Fine sand conforming to ASTM C144 combined with polymer binders for creating semi-solid joints between pavers.

1. Material: Granite.
2. Additive(s): Portland Cement.
3. Compressive Strength: 750 pounds per square inch (5 MPa).
4. Adhesion by Tensile Load: 100 pounds per square inch (0.7 MPa).
5. Color: Beige.

2.04 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M Type I, white color.

B. Sand: ASTM C144; sharp, clean, screened sand free of injurious amounts of organic material.

C. Premixed Grout Mortar:

D. Water: Potable, not detrimental to mix.

2.05 ACCESSORIES

A. Welded Wire Reinforcement: ASTM A1064/A1064M; 2 x 2, 16/16 wire (50 x 50, 1.5/1.5 wire); galvanized steel.

B. Mortar Bed Joint Filler: Preformed compressible strip complying with ASTM D1751 or ASTM D1752, or closed-cell non-absorbent compressible polyethylene or polymer foam in sheet form; thickness as required to form joint of indicated width; intended to remain in joint to allow moderate movement.

C. Sealant: ASTM C920, self-leveling or nonsag polyurethane or silyl-terminated polyether/polyurethane (STPE/STPU) sealant explicitly approved by manufacturer for traffic exposure without being recessed below the top of substrate surface.

1. Color: As selected by Architect from manufacturer's full color range.

D. Backer Rod: ASTM C1330, closed-cell polyethylene, 25 to 33 percent larger in diameter than joint width.

E. Cleaning Solution:

2.06 MIXES

A. Mortar Bed: Portland cement mix conforming to the following:

1. Compressive Strength (28 day): 2000 psi (15 MPa).
2. Slump: 3 to 4 inches (75 to 100 mm).
3. Air Entrainment: 5 to 7 percent.

B. Joint Grout: Portland cement mix conforming to the following:

1. Compressive Strength (28 day): 3000 psi (20 MPa).

2. Slump: 1 to 2 inches (25 to 50 mm).
3. Air Entrainment: 5 to 7 percent.
4. Color Admixture: In accordance with manufacturer's instructions.

C. Add admixtures in accordance with manufacturer's instructions.

D. Thoroughly mix ingredients in quantities needed for immediate use.

E. Use within two hours after mixing. Do not re-temper.

2.07 FABRICATION

A. Fabrication Tolerances For Stone Units: Within 1/8 inch (3 mm) of actual dimensions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate is level, smooth, capable of supporting pavers and imposed loads, and ready to receive work of this section.

B. Verify that concrete substrate has cured at least 28 days.

C. Verify gradients and elevations of substrate are correct.

D. Verify dry weather forecast without rain for a minimum of 24 hours with temperatures above 55 degrees Fahrenheit (13 degrees Celsius).

E. Verify that pavers are completely dry prior to polymeric sand installation.

3.02 PREPARATION

A. See Section 31 2200 for subsoil preparation.

B. See Section 31 2323 for fill compaction requirements.

C. See Section 32 1216 for pavement subbase.

D. See Section 32 1313 for concrete subbase.

3.03 INSTALLATION - SAND SETTING BED

A. Spread sand evenly over prepared substrate to a maximum thickness of 1-1/2 inch (38 mm).

B. Dampen and roller compact sand to level and even surface.

C. Screed and scarify top 1/2 inch (13 mm) of sand.

D. Place paver units in herringbone pattern, from straight reference edge.

E. Place half units, special shaped units, and curbs at edge and interruptions. Maintain tight joints.

F. Sprinkle sand over surface, sweep into joints and moisten. Recover with additional sand until firm joints are achieved. Remove excess sand.

G. Tamp and level paver units with mechanical vibrator until units are firmly bedded, level, and to correct elevation and gradients.

3.04 INSTALLATION - MORTAR SETTING BED

A. Wear clothing and equipment to protect from excessive exposure to polymeric sand.

B. Locate control and expansion joints directly above joints in structural base and where indicated on drawings; use joint filler to form full depth joint before laying mortar bed.

1. Control Joints: 1/2 inch (13 mm) wide.

2. Expansion Joints: 1/2 inch (13 mm) wide.

C. Set paver units in full mortar bed of minimum 1 inch (25 mm) thickness, to support pavers over full bearing surface.

D. Place reinforcement at mid-height of bed thickness.

E. Place paver units in herringbone pattern, from straight reference edge.

F. Place half units, special shaped units, and curbs at edges and interruptions. Machine saw partial units.

G. Maintain uniform joint width of 3/8 inch (9 mm) between pavers, and at abutting vertical surfaces and protrusions. To accommodate grout, rake out joints 1/4 to 3/8 inch (6 to 9 mm) deep.

H. Keep control and expansion joints free of grout, for sealant installation.

I. Fill joints with grout; pack and work into voids; neatly tool surface to concave joint. Wet cure.

J. Spread polymeric sand uniformly over surface. Use a push broom to fill joints and remove excess while not sweeping long distances. Sweep all excess with a fine bristle brush and remove residues with a leaf blower.

K. Seal control and expansion joints with sealant, in accordance with sealant manufacturer's instructions; use joint filler, backer rod, and or bond breaker tape to achieve width-to-depth ratio recommended by sealant manufacturer.

3.05 CLEANING

A. Do not clean pavers until pavers and mortar are dry.

B. Clean soiled surfaces using cleaning solution. Do not harm pavers, joint materials, or adjacent surfaces.

C. Use non-metallic tools in cleaning operations.

D. Rinse surfaces with clean water.

E. Broom clean paving surfaces. Dispose of excess sand.

F. See Section 01 7419 for construction waste management and disposal.

3.06 PROTECTION

A. Do not permit traffic over sealant joints until sealant is fully cured.

B. Do not permit traffic over unprotected paver surface.

C. Protect paver surface with sheets of plywood.

3.07 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide a separate maintenance contract for specified maintenance service. Term of contract shall be determined in writing by PGCPS.

END OF SECTION

SECTION 32 1723.13
PAINTED PAVEMENT MARKINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Parking lot markings, including parking bays, crosswalks, arrows, handicapped symbols and curb markings.

B. Roadway lane markings and crosswalk markings.

1.02 RELATED REQUIREMENTS

A. Section 32 1216 - Asphalt Paving.

B. Section 32 1313 - Concrete Paving.

C. Section 32 1726 - Tactile Warning Surfacing: Plastic tactile and detectable warning tiles for pedestrian walking surfaces.

1.03 REFERENCE STANDARDS

A. FS TT-B-1325 - Beads (Glass Spheres); Retro-Reflective 2007d (Validated 2017).

B. FS TT-P-1952 - Paint, Traffic Black, and Airfield Marking, Waterborne 2015f.

C. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association Current Edition.

D. FHWA MUTCD - Manual on Uniform Traffic Control Devices for Streets and Highways; U.S. Department of Transportation, Federal Highway Administration Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Certificates: Submit for each batch of paint and glass beads stating compliance with specified requirements.

D. Maintenance Materials: Furnish the following for Owner 's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Paint: 2 containers, 1 gallon (4 liter) size, of each type and color.

1.05 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of Prince George’s County and Maryland Department of Transportation for pavement-marking work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver paint in containers of at least 5 gallons (18 L) accompanied by batch certificate.

B. Deliver glass beads in containers suitable for handling and strong enough to prevent loss during shipment accompanied by batch certificate.

C. Store products in manufacturer's unopened packaging until ready for installation.

D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

PART 2 PRODUCTS

2.01 MATERIALS

A. Line and Zone Marking Paint: MPI (APL) No. 97 Latex Traffic Marking Paint; color(s) as indicated.

1. Roadway Markings: As required by authorities having jurisdiction.

2. Parking Lots: Yellow.

3. Handicapped Symbols: Blue.

B. Line and Zone Marking Paint: Refer to Section 09 9000.

C. Paint For Obliterating Existing Markings: FS TT-P-1952; black for bituminous pavements, gray for portland cement pavements.

D. Reflective Glass Beads: FS TT-B-1325, Type I (low index of refraction), Gradation A (coarse, drop-on) ; with silicone or other suitable waterproofing coating to ensure free flow.

E. Temporary Marking Tape: Preformed, reflective, pressure sensitive adhesive tape in color(s) required; Contractor is responsible for selection of material of sufficient durability as to perform satisfactorily during period for which its use is required.

F. Tactile Warning Surfaces: See Section 32 1726.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

B. Obliteration of existing markings using paint is acceptable in lieu of removal; apply the black paint in as many coats as necessary to completely obliterate the existing markings.

C. Clean surfaces thoroughly prior to installation.

1. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods.

2. Completely remove rubber deposits, existing paint markings, and other coatings adhering to the pavement, by scraping, wire brushing, sandblasting, mechanical abrasion, or approved chemicals.

D. Where oil or grease are present, scrub affected areas with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinse thoroughly after each application; after cleaning, seal oil-soaked areas with cut shellac to prevent bleeding through the new paint.

E. Establish survey control points to determine locations and dimensions of markings; provide templates to control paint application by type and color at necessary intervals.

F. Temporary Pavement Markings: When required or directed by Architect , apply temporary markings of the color(s), width(s) and length(s) as indicated or directed.

1. After temporary marking has served its purpose, remove temporary marking by carefully controlled sandblasting, approved grinding equipment, or other approved method so that surface to which the marking was applied will not be damaged.

2. At Contractor 's option, temporary marking tape may used in lieu of temporary painted marking; remove unsatisfactory tape and replace with painted markings at no additional cost to Owner .

3.03 INSTALLATION

A. Begin pavement marking as soon as practicable after surface has been cleaned and dried.

B. Do not apply paint if temperature of surface to be painted or the atmosphere is less than 50 degrees F (10 degrees C) or more than 95 degrees F (35 degrees C).

C. Apply in accordance with manufacturer's instructions using an experienced technician that is thoroughly familiar with equipment, materials, and marking layouts.

D. Comply with FHWA MUTCD manual (http://mutcd.fhwa.dot.gov) for details not shown.

E. Apply markings in locations determined by measurement from survey control points; preserve control points until after markings have been accepted.

F. Apply uniformly painted markings of color(s), lengths, and widths as indicated on drawings true, sharp edges and ends.

1. Apply paint in one coat only.

2. Wet Film Thickness: 0.015 inch (0.4 mm), minimum.

3. Width Tolerance: Plus or minus 1/8 inch (3 mm).

G. Roadway Traffic Lanes: Use suitable mobile mechanical equipment that provides constant agitation of paint and travels at controlled speeds.

1. Conduct operations in such a manner that necessary traffic can move without hindrance.

2. Place warning signs at the beginning of the wet line, and at points well in advance of the marking equipment for alerting approaching traffic from both directions. Place small flags or other similarly effective small objects near freshly applied markings at frequent intervals to reduce crossing by traffic.

3. If paint does not dry within expected time, discontinue paint operations until cause of slow drying is determined and corrected.

4. Skip Markings: Synchronize one or more paint "guns" to automatically begin and cut off paint flow; make length of intervals as indicated.

5. Use hand application by pneumatic spray for application of paint in areas where a mobile paint applicator cannot be used.

6. Distribute glass beads uniformly on the paint lines within ten seconds without any waste, applied at rate of 6 pounds per gallon (720 g per L) of paint; if the marking equipment does not have a glass bead dispenser, use a separate piece of equipment adjusted and synchronized with the paint applicator; remove and replace markings having faulty distribution of beads.

H. Parking Lots: Apply parking space lines, entrance and exit arrows, painted curbs, and other markings indicated on drawings.

1. Mark the International Handicapped Symbol at indicated parking spaces.

2. Hand application by pneumatic spray is acceptable.

I. Symbols: Use a suitable template that will provide a pavement marking with true, sharp edges and ends, of the design and size indicated.

3.04 DRYING, PROTECTION, AND REPLACEMENT

A. Protect newly painted markings so that paint is not picked up by tires, smeared, or tracked.

B. Provide barricades, warning signs, and flags as necessary to prevent traffic crossing newly painted markings.

C. Allow paint to dry at least the minimum time specified by the applicable paint standard and not less than that recommended by the manufacturer.

D. Remove and replace markings that are applied at less than minimum material rates; deviate from true alignment; exceed length and width tolerances; or show light spots, smears, or other deficiencies or irregularities.

E. Remove markings in manner to avoid damage to the surface to which the marking was applied, using carefully controlled sand blasting, approved grinding equipment, or other approved method.

F. Replace removed markings at no additional cost to Owner .

END OF SECTION

SECTION 32 1726
TACTILE WARNING SURFACING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Plastic tactile and detectable warning tiles for pedestrian walking surfaces.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete for sidewalks and platforms.

B. Section 32 1313 - Concrete Paving: Concrete sidewalks.

C. Section 32 1723.13 - Painted Pavement Markings: Crosswalk and curb markings.

1.03 REFERENCE STANDARDS

A. 49 CFR 37 - Transportation Services for Individuals with Disabilities (ADA) current edition.

B. AASHTO LRFD - Bridge Design Specifications 2017.

C. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

D. ASTM A48/A48M - Standard Specification for Gray Iron Castings 2003 (Reapproved 2016).

E. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

F. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus 2018.

G. ASTM C501 - Standard Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser 1984 (Reapproved 2015).

H. ASTM C903 - Standard Practice for Preparing Refractory Specimens by Cold Gunning 2015, with Editorial Revision (2016).

I. ASTM D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine 2011.

J. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents 2014.

K. ASTM D570 - Standard Test Method for Water Absorption of Plastics 1998 (Reapproved 2010).

L. ASTM D638 - Standard Test Method for Tensile Properties of Plastics 2014.

M. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics 2015.

N. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials 2016.

O. ASTM D1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes 2002 (Reapproved 2013).

P. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2018b.

Q. ASTM G155 - Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials 2013.

R. ATBCB PROWAG - Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way 2011.

S. SAE AMS-STD-595 - Colors Used in Government Procurement 2017a.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's product data, standard details, details specific to this project; written installation and maintenance instructions.

C. Samples: For each product specified provide two samples, 8 inches (203 mm) square, minimum; show actual product, color, and patterns.

D. Shop Drawings: Submit plan and detail drawings. Indicate:

1. Locations on project site. Demonstrate compliance with referenced accessibility standards.
2. Sizes and layout.
3. Pattern spacing and orientation.
4. Attachment and fastener details, if applicable

E. Warranty: Submit manufacturer warranty; complete forms in Owner's name and register with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years documented experience.

B. Installer Qualifications: Company certified in writing by product manufacturer as having successfully completed work substantially similar to the work of this section.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver to project site in manufacturer's protective wrapping and in manufacturer's unopened packaging.

B. Store covered and elevated above grade and in manufacturer's unopened packaging until ready for installation. Maintain at ambient temperature between 40 and 90 degrees F (4 and 32 degrees C).

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Plastic Tiles: Provide manufacturer's standard five year warranty against manufacturing defects, breakage or deformation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Plastic Tactile and Detectable Warning Surface Tiles:

1. Access Tile, a brand of Access Products, Inc: www.accesstile.com/#sle.
2. ADA Solutions, Inc: www.adatile.com/#sle.
3. Armor-Tile, a brand of Engineered Plastics, Inc: www.armortiletransit.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 TACTILE AND DETECTABLE WARNING DEVICES

A. Plastic Tactile and Detectable Warning Tiles: ADA Standards compliant, glass fiber and carbon fiber reinforced, exterior grade, matte finish polyester sheet with truncated dome pattern, solid color throughout, internal reinforcing of sheet and of truncated domes, integral radius cut lines on back face of tile; with factory applied removable protective sheeting.

1. Material Properties:

a. Water Absorption: 0.20 percent, maximum, when tested in accordance with ASTM D570.

b. Slip Resistance: 0.50 minimum dry static coefficient of friction, when tested in accordance with ASTM D2047.

c. Compressive Strength: 25,000 pounds per square inch (172 MPa), minimum, when tested in accordance with ASTM D695.

d. Tensile Strength: 10,000 pounds per square inch (69 MPa), minimum, when tested in accordance with ASTM D638.

e. Flexural Strength: 25,000 pounds per square inch (172 MPa) minimum, when tested in accordance with ASTM D790.

f. Chemical Stain Resistance: No reaction to 1 percent hydrochloric acid, motor oil, calcium chloride, gum, soap solution, bleach, or antifreeze, when tested in accordance with ASTM D543.

g. Abrasion Resistance: 300, minimum, when tested in accordance with ASTM C501.

h. Flame Spread Index: 25, maximum, when tested in accordance with ASTM E84.

i. Accelerated Weathering: Delta-E of less than 5.0 at 2,000 hours exposure, when tested in accordance with ASTM G155.

j. Adhesion: No delamination of tile prior to board failure in a temperature range of 20 to 180 degrees F (minus 7 to 82 degrees C), when tested in accordance with ASTM C903.

k. Loading: No damage when tested according to AASHTO LRFD test method HS20.

l. Salt and Spray Performance: No deterioration or other defect after 200 hours of exposure, when tested in accordance with ASTM B117.

2. Installation Method: Cast in place.

3. Shape: Rectangular.

4. Dimensions: 24 inches by 48 inches (610 mm by 1220 mm).

5. Pattern: In-line pattern of truncated domes complying with ADA Standards.

6. Edge: Square.

7. Joint: Butt.

8. Color: SAE AMS-STD-595, Table IV, Federal Yellow No. 33538.

9. Products:

a. ADA Solutions, Inc; Transit Use - In-Line Dome Surface Applied System: www.adatile.com/#sle.

2.03 ACCESSORIES

A. Fasteners: ASTM A666, Type 304 stainless steel

1. Type: Countersunk, color matched composite sleeve anchors

2. Size: 1/4 inch (6.35 mm) diameter and 1-1/2 inches (38 mm) long.

B. Adhesive: Type recommended and approved by surfacing tile manufacturer.

C. Sealant: Elastomeric sealant of color to match adjacent surfaces; approved by surfacing tile manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. When installation location is near site boundary or property line, verify required location using property survey.

B. Verify that work area is ready to receive work:

1. Examine work area with installer present.

2. If existing conditions are not as required to properly complete the work of this section, notify Architect.

3. Do not proceed with installation until deficiencies in existing conditions have been corrected.

C. Verify that dimensions, tolerances, and attachment methods for work in this section are properly coordinated with other work on site.

3.02 INSTALLATION, GENERAL

A. Install in accordance with manufacturer's written instructions.

1. Do not install damaged, warped, bowed, dented, abraded, or otherwise defective units.

2. Do not install when ambient or substrate temperature has been below 40 degrees F (4 degrees C) during the preceding 8 daylight hours.

B. Field Adjustment:

1. Cut units to size and configuration shown on drawings.

2. Locate relative to curb line in compliance with ATBCB PROWAG, Sections 304 and 305.

3. Orient so dome pattern is aligned with the direction of ramp.

4. Align truncated dome pattern between adjacent units.

C. Install units fully seated to substrate, square to straight edges and flat to required slope.

D. Align units so that tops of adjacent units are flush and joints between units are uniform in width.

3.03 INSTALLATION, CAST IN PLACE PLASTIC TILES

A. Concrete:

1. See Section 03 3000.

2. Slump: 4 to 7 percent.

B. When installing multiple adjacent units, leave a 3/16 inch (5 mm) gap between units to allow for expansion.

C. Tamp and vibrate units as recommended by manufacturer.

D. Place and position weights on units while concrete cures as recommended by manufacturer. Ensure no voids or air pockets exist between top surface of concrete and underside of units.

3.04 INSTALLATION, SURFACE APPLIED PLASTIC TILES

A. Cure concrete surfaces for a minimum of 4 days before installing units.

B. Verify substrate is clean and dry; free of voids, projections and loose material. Remove dust, oil, grease, curing compounds, sealers and other substances that may interfere with adhesive bond or sealant adhesion.

C. Mechanically roughen surface as required to remove contaminants and prepare surface for adhesive and sealant application.

D. Drill fastener holes straight, true and to depth recommended by manufacturer.

E. Apply adhesive to back of unit as recommended by manufacturer.

F. Mechanically fasten to substrate. Avoid striking or damaging the unit itself during installation.

G. Apply sealant to edges in cove profile.

3.05 CLEANING PLASTIC UNITS

A. Remove protective plastic sheeting within 24 hours of installation.

B. Remove excess sealant or adhesive from joints and edges.

C. Clean four days prior to date of scheduled inspection.

3.06 PROTECTION

A. Protect installed units from traffic, subsequent construction operations or other imposed loads until concrete is fully cured.

B. Touch-up, repair or replace damaged products prior to Date of Substantial Completion.

END OF SECTION

SECTION 32 1813
SYNTHETIC GRASS SURFACING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Synthetic grass surfacing and infill.

B. Edge anchoring and borders.

C. Shock absorbing course.

D. Correction of grades and subgrade.

E. Drainage layer.

F. Field graphics.

1.02 RELATED REQUIREMENTS

A. Section 01 2100 - Allowances: Cash, testing, and contingency allowances.

B. Section 01 2200 - Unit Prices: Descriptions of unit price items, administrative requirements.

C. Section 03 3000 - Cast-in-Place Concrete.

D. Section 31 2316 - Excavation.

E. Section 31 2316.13 - Trenching.

F. Section 31 2323 - Fill.

G. Section 32 3113 - Chain Link Fences and Gates.

H. Section 33 4211 - Stormwater Gravity Piping.

1.03 REFERENCE STANDARDS

A. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.

B. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete 2017a.

C. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates 2014.

D. ASTM C476 - Standard Specification for Grout for Masonry 2018.

E. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)) 2012, with Editorial Revision (2015).

F. ASTM D1335 - Standard Test Method for Tuft Bind of Pile Yarn Floor Coverings 2017, with Editorial Revision (2018).

G. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN m/m3)) 2012, with Editorial Revision (2015).

H. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials 2016.

I. ASTM D5823 - Standard Test Method for Tuft Height of Pile Floor Coverings 2013.

J. ASTM D6662 - Standard Specification for Polyolefin-Based Plastic Lumber Decking Boards 2017.

K. ASTM F1292 - Standard Specification for Impact Attenuation of Surfacing Materials Within the Use Zone of Playground Equipment 2017.

L. ASTM F1487 - Standard Consumer Safety Performance Specification for Playground Equipment for Public Use 2017.

M. ASTM F1632 - Standard Test Method for Particle Size Analysis and Sand Shape Grading of Golf Course Putting Green and Sports Field Rootzone Mixes 2003 (Reapproved 2010).

N. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples 2018.

O. ASTM F1936 - Standard Specification for Impact Attenuation of Turf Playing Systems as Measured in the Field 2010 (Reapproved 2015).

P. ASTM F2765 - Standard Specification for Total Lead Content in Synthetic Turf Fibers 2014.

Q. ASTM F2898 - Standard Test Method for Permeability of Synthetic Turf Sports Field Base Stone and Surface System by Non-confined Area Flood Test Method 2011.

R. ASTM STP322-1 - Field Testing of Soils, Chapter 1: Field Percolation Tests for Sanitary Engineering Application 1962.

S. CPSC Pub. No. 325 - Public Playground Safety Handbook 2010.

1.04 ADMINISTRATIVE REQUIREMENTS

A. See Section 01 3000 - Administrative Requirements - Administrative Requirements, for project meetings.

B. Preinstallation Meeting: Conduct a preinstallation meeting 1 week prior to the start of the work of this section; require attendance by all affected installers.

C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: For all manufactured surfacing products, provide manufacturer's product data showing materials of construction, compliance with specified standards, installation procedures, and safety limitations.

1. Include STC certifications where required.
2. Treated Wood Products: Provide information on wood treatment chemical content, toxicity level, and life-cycle durability.

C. Shop Drawings: Carpet Roll: Show locations of seams and methods of seaming.

1. Field Graphics: Include methods of seaming.

D. Samples: For each product for which color must be selected provide color chart showing full range of colors.

E. Samples: Provide the following prior to ordering material:

1. Synthetic Grass carpet: Two 12 inch by 12 inch (305 mm by 305 mm) pieces.
2. Infill material: Two 1 gallon bags for each type.
3. Seamed synthetic grass carpet: Two 12 inch by 24 inch (305 mm by 610 mm) pieces seemed together for each seaming method indicated on drawings.
4. Shock absorbing material: two 1 gallon bags for each type.
5. Field graphics synthetic grass carpet: Two 12 inch by 12 inch (305 mm by 305 mm) pieces for each color indicated on drawings.

F. Percolation Test Report: Describing test method used and results.

G. Manufacturer's Qualification Statement.

H. Installer's Qualification Statement.

I. Maintenance Data:

1. For manufactured surfacing products, provide manufacturer's recommended maintenance instructions and list of repair products, with address and phone number of source of supply.
2. For loose fill surfacing products, provide detailed re-ordering information to enable Owner to match installed material exactly.

J. Manufacturer's Field Report.

K. Topographical survey of loose fill layer prior to installation of synthetic grass carpet.

L. Certification: Provide IPEMA certification of ASTM F1292 Critical Fall Height at thickness specified.

1.06 QUALITY ASSURANCE

A. See section 01 4000 - Quality Requirements, for procedures for testing, inspection, mock-ups, reports, certificates, use of reference standards.

B. Maintain one copy of the latest edition of ASTM F1487 and CPSC Pub. No. 325 at project site.

C. Manufacturer Qualifications: Company regularly engaged in manufacturing products specified in this section, with not less than three years of documented experience.

1. Surfacing installed in minimum 10 sites and been in successful service minimum 5 years.
2. Manufacturer's Representative: Provide name, company name and address, and qualifications.

D. Installer Qualifications: Company certified by manufacturer for training and experience installing the protective surfacing; provide installer's company name and address, and training and experience certificate.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store synthetic grass surfacing to project site in accordance with manufacturer's recommendations.

B. Store materials in a dry, covered area, elevated above grade.

1.08 FIELD CONDITIONS

A. Ambient Conditions: Work under this section will cease when:

1. Temperatures are below 55 degrees F.
2. Humidity levels are above the adhesive manufacturer's requirements.
3. Rain is imminent or falling.
4. Surfaces are wet or damp.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals - Closeout Submittals, for additional warranty requirements.

B. Provide 10 year minimum warranty from the date of substantial completion for materials and installation covering:

1. Excessive wear.
2. Fiber tensile strength.
3. Deterioration or fading from UV light.
4. Seam integrity.
5. Shock absorption.

6. Drainage rate.

PART 2 PRODUCTS

2.01 SYNTHETIC GRASS SURFACING

A. Synthetic Grass Carpet: Yarn fibers tufted through and adhered to a porous fiber backing.
   1. Primary Blades:
      a. Fibers: Monofilament.
      b. Material: Polyethylene.
      c. Weight: 40 ounces per square yard (1.4 l/sm).
      d. Height: 1-1/4 inch (32 mm), in compliance with ASTM D5823.
      e. Tuft Bind: 8 pounds-force, minimum, in compliance with ASTM D1335.
   2. Secondary Blades:
      a. Fibers: Monofilament.
      b. Material: Polyethylene.
      c. Weight: 40 ounces per square yard (1.4 l/sm).
      d. Height: 1 inch (25 mm), in compliance with ASTM D5823.
      e. Tuft Bind: 8 pounds-force, minimum, in compliance with ASTM D1335.
   3. Backing:
      a. First: Single layer of woven polyester treated with UV inhibitors.
      b. Second: Coating of polyurethane.
      c. Third: Geotextile fleece.
      d. Backing Weight: 20 ounces per square meter (3 l/sm).
   4. Face Weight: Minimum 40 ounces per square yard (1.4 l/sm).
   5. Permeability: 10 inches (254 mm) of water per hour, minimum.
   6. Lead Content: 100 ppm, maximum, in compliance with ASTM F2765.
   7. Roll: 10 feet (3 m) feet wide, minimum.
   8. Noncombustible: Pass ASTM D2859 for flammability.
   9. Field Graphics:
      a. Applied Marking: Permanent paint, per manufacturer's approval.

B. Synthetic Grass Infill: 2 pounds per square foot (10 ksm), minimum at 50-50 percent rubber granule to synthetic sand:
   1. Rubber granule: SBR, 10-20 mesh, free of metals, nonmetal fibers, and contaminants.
   2. Sand: Silica, 10-20 mesh, free of silts, clays, and contaminants, roundness of subangular, minimum, per ASTM F1632.

C. Shock Absorbing Course:
   1. Recycled Rubber Fill: Loose fill; 100 percent recycled rubber chips, shreds, granules, or nuggets; installed over subgrade.
      a. Chip Size: 3/8 inch (9 mm).

b. Depth: As indicated on drawings.

2. Impact Mats:

a. In Situ Cushion: Shredded rubber bonded with polyurethane adhesive, allowing water penetration, over aggregate subbase.

1) Rubber: 100 percent recycled shredded styrene butadiene rubber (SBR) shreds or granules.

2) Depth: As indicated on drawings.

2.02 MATERIALS

A. Edge Anchoring: Wood-polymer composite lumber complying with ASTM D6662; factory finished, free of sharp vertical edges, protruding elements, and trip hazards, capable of being secured to the border.

1. Size(s): 2 inch by 3 inch (51 mm by 76mm).

2. Minimum Edge Radius: 1/2 inch (13 mm).

B. Border: Permanent element surrounding edge anchoring, consisting of exterior walls:

1. Exterior Walls: As indicated on drawings.

2. Sidewalks: As indicated on drawings.

3. Precast Concrete Curb: 12 inch wide by 6 inch deep (305 mm by 152 mm), smooth top.

4. Chain Link Fence: As indicated on drawings.

C. Drainage (Loose Surfacing) Course: Fractured, non-rounded gravel; washed; free of dust, clay, dirt, organic material, hazardous substances, or foreign objects; rounded particles, either naturally or mechanically; sieved in compliance with ASTM C136/C136M in the specified gradation range.

1. Percent Passing Sieve Size 1/2 inch (13 mm): 100 percent.

2. Percent Passing Sieve Size 3/8 inch (10 mm): 75 to 85 percent.

3. Percent Passing Sieve Size No. 4 (5 mm): 0 percent.

4. Depth: As indicated on drawings.

D. Drainage (Base Stone) Course: Fractured, non-rounded gravel; washed; free of dust, clay, dirt, organic material, hazardous substances, or foreign objects; rounded particles, either naturally or mechanically; sieved in compliance with ASTM C136/C136M in the specified gradation range.

1. Percent Passing Sieve Size 1-1/2 inch (38 mm): 100 percent.

2. Percent Passing Sieve Size 3/4 inch (19 mm): 75 to 85 percent.

3. Percent Passing Sieve Size 1/2 inch (13 mm): 40 to 70 percent.

4. Percent Passing Sieve Size 3/8 inch (10 mm): 75 to 85 percent.

5. Percent Passing Sieve Size No. 4 (5 mm): 0 percent.

6. Depth: As indicated on drawings.

E. Drainage Pipes: Uniform material, free of defects:

1. Material: Polyvinyl Chloride.

2. Shape: Round.

3. Perforations: As indicated on drawings.

4. Size: As indicated on drawings.

F. Geotextile Fabric: Nonwoven Polypropylene Sheet.

2.03 ACCESSORIES

A. Fasteners, Synthetic Grass to Edging: 1/2 inch (13 mm) stainless steel staples, in compliance with ASTM F1667.

B. Fasteners, Edging to Border: Self drilling, stainless steel screws, in compliance with ASTM F1667.

C. Fasteners, Seams:

1. Nails: Galvanized steel, 4 inch (102 mm) long, in compliance with ASTM F1667.

D. Rebar: Number 4 rod.

E. Cementitious Grout: Fine, in compliance with ASTM C476.

2.04 SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

PART 3 EXECUTION

3.01 PREPARATION

A. Lay out entire project perimeter as indicated on drawings prior to starting work.

B. Measure the location of all synthetic grass elements, including perimeter of existing synthetic grass surfacing, access and egress points, hard surfaces, walls, fences, and structures.

C. Verify location of underground utilities and facilities in the project area. Damage to underground utilities and facilities will be repaired at Contractor's expense.

3.02 SUBGRADE

A. Excavate unsuitable soils as specified in Section 31 2316. Backfill with suitable material as specified in Section 31 2323.

B. Correct irregularities to ensure that required depth of drainage layer can be installed, and elevation is in accordance with manufacturer's requirements.

C. Remove all obstructions that extend into the drainage layer within the composite nailer boards.

D. Perform rough and finish grading as specified in Section 31 2200.

E. Shape to profile indicated on drawings and compact by proof rolling to a minimum 95 percent, in compliance with ASTM D698.

F. Flatness Tolerance: 1/2 inch in 10 feet (12 mm in 3 m), maximum.

G. Perform percolation test at the lowest elevation of the subgrade, in compliance with ASTM STP322-1.

1. Report results to Architect .

2. If percolation is less than 1 inch (25 mm) in a 3 hour period, do not proceed.

H. Verify that subgrades are at proper elevations and that smooth grading is complete.

3.03 TRENCHING AND BACKFILLING

A. Lay out trenching for entire drainage network prior to excavation, as indicated on drawings.

B. Excavate trenches in accordance with drawings.

C. Mirror base of trenches to finish grade.

D. Open trenches require the presence of daily site activity.

E. Repair any deviations from plans after drainage pipe installation and prior to installing geotextile fabric.

F. Perform trenching as specified in Section 31 2316.13.

3.04 DRAINAGE PIPE

A. Install all piping and fittings as indicated on drawings.

B. Install collector lines prior to laterals with deepest excavations first.

C. Connect collector lines to discharge outlet prior to field use.

D. Completion of installation in accordance to design requires approval by Architect.

E. Install drainage pipe as specified in Section 33 4211.

3.05 GEOTEXTILE FABRIC

A. Verify that subgrade is free of ruts or protruding objects.

B. Install geotextile fabric over subgrade in in drainage trenches first, prior to field installation.

C. Lap minimum 36 inches (915 mm) width at seams. Adhere seams in accordance with manufacturer's recommendations.

D. Install fabric smooth, and free of tensile stresses, folds, or wrinkles.

E. Protect fabric from clogging, tears, or other damage during surfacing installation.

F. Repair or replace damaged fabric in accordance with manufacturer's recommendations.

3.06 DRAINAGE AGGREGATE

A. Loose Fill Surfacing:

1. Install in compliance with CPSC Pub. No. 325, ASTM F1487, and requirements of authorities having jurisdiction (AHJ).
2. Install aggregate subbase as indicated on drawings and in Section 32 1123. Compact aggregate to maximum 95 percent, in compliance with ASTM D1557.
3. Compact to minimum 95 percent density, in compliance with ASTM D698.
4. Flatness Tolerance: 1/4 inch in 10 feet (6 mm in 3 m), maximum.
5. Correct high and low areas in accordance with design drawings.
6. Match top of layer with top of edge anchoring.
7. Prevent base stone from entering into loose fill surfacing layer. Prevent loose fill from entering into base stone layer.

B. Base Stone:

1. Install aggregate subbase as indicated on drawings and in Section 32 1123. Compact aggregate to maximum 95 percent, in compliance with ASTM D1557.
2. Install in compliance with CPSC Pub. No. 325, ASTM F1487, and requirements of authorities having jurisdiction (AHJ).
3. Compact to minimum 95 percent density, in compliance with ASTM D698.
4. Flatness Tolerance: 1/2 inch in 10 feet (12 mm in 3 m), maximum.
5. Correct high and low areas in accordance with design drawings.
6. Mirror base stone elevations to final elevations.
7. Prevent disturbance to geotextile fabric during installation.

8. Approval of drainage piping by Architect required prior to commencement of installation. Prevent disturbance of drainage piping during installation.

3.07 SHOCK ABSORBING COURSE

A. Recycled Rubber Fill:

1. Install to thickness meeting critical fall heights, as determined by ASTM F1292, or according to drawings.
2. Install in a smooth level manner without depressions or rises.
3. Compact until adult foot depressions do not occur.

B. Impact Mats:

1. In Situ Cushion:
   a. Mix SBR and adhesive mechanically on-site in accordance with manufacturer's directions; do not mix by hand.
   b. Install in a continuous bond; ensure complete bond to subbase.
   c. Maintain full thickness of resilient layers within Use Zone; cover or abut containment curbs as indicated on drawings; completely cover tapered transition edges.
   d. Hand trowel exposed surface to smooth, even finish.
   e. Impact Attenuation Layer: Install entire layer in one continuous pour on the same day.

3.08 EDGE ANCHORING

A. Layout composite nailer boards. Approval of locations by Architect required prior to installing.

B. Install along full perimeter of synthetic grass.

C. Fasten to border with case hardened screws at 24 inch (610 mm) on center, minimum.

D. Set top of edging flush or recessed 1/2 inch (13 mm) below top of border, maximum.

3.09 BORDER

A. Verify that site furnishings and composite nailer boards located within project area are complete.

B. Install border walls according to design drawings.

C. Sidewalks: Match to top elevation or increase by 1/2 inch (13 mm) above edge anchoring, maximum. Install cast-in-place sidewalks as specified in Section 03 3000.

D. Chain Link Fence: Align centerlines of fence and curb. Apply grout to each curb hole installed with fence post, securing post in place. Install chain link fences and gates as specified in Section 32 3113.

3.10 SYNETHETIC GRASS

A. Carpet Rolls:

1. Unroll all carpet in the same direction.
2. Prevent seams from being located over impact mats.
3. Allow carpet to rest for at least 4 hours after unrolling and prior to seaming.
4. Smooth seams and edges, eliminate overlaps and gaps.

B. Seaming:

1. Cut: Straight, with a clean and smooth edge.
2. Method:

a. Nailing / Stapling: Spaced 3 inch (76 mm) along seam.

b. Sewing: 2 thread, bound seam stitch.

c. Bonding: adhesive-backed, applied uniformly with complete coverage.

d. Micromechanical: Utilizing hook-and-loop fasteners.

C. Securing: Staple carpet to edging 1 inch (25 mm) on center.

D. Field Graphics:

1. Applied Marking: Per manufacturer recommendations, in dimensions and color patterns indicated on drawings.

2. Inlaid Marking:

a. Shearing: Cut the synthetic grass through the backing, in dimensions and pattern indicated on drawings.

b. Inlay: Bond synthetic grass in colors indicated on drawings within sheared patterns.

3.11 INFILL

A. Apply during dry weather without signs of moisture on synthetic grass.

B. Thoroughly brush synthetic grass prior to infill installation.

C. Apply infill uniformly in multiple lifts, brush fibers between each application.

D. Measure depth to confirm accordance with plans.

3.12 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Drainage aggregate completion requires approval by Architect.

C. Owner or Owner's representative will inspect synthetic grass after installation to verify that surfacing is of proper type and meets specified design safety and accessibility requirements.

D. Repair or replace rejected work until compliant with specified requirements and design criteria.

E. Confirm rainfall permeability meets design, per ASTM F2898.

F. Confirm impact attenuation meets design, per ASTM F1936.

G. Replace damaged products before Date of Substantial Completion.

3.13 CLEANING

A. Clean surrounding areas of excess construction materials, debris, and waste.

B. Remove excess and waste material and dispose of off-site in accordance with requirements of authorities having jurisdiction.

C. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

3.14 PROTECTION

A. Protect installed products until Date of Substantial Completion.

B. Restore adjacent existing areas that have been damaged by work of this section.

END OF SECTION

SECTION 32 1816.13
PLAYGROUND PROTECTIVE SURFACING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Removal of existing protective surfacing and correction of grades as necessary.

B. Protective surfacing for playground area.

C. Subbase under resilient surfacing.

D. Containment curbs.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

B. Section 11 6813 - Playground Equipment: Playground layout (staking).

C. Section 32 1123 - Aggregate Base Courses: Subbase for resilient surfacing.

D. Section 32 1216 - Asphalt Paving: Subbase for resilient surfacing.

E. Section 32 1313 - Concrete Paving: Subbase for resilient surfacing.

1.03 REFERENCE STANDARDS

A. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete 2017a.

B. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates 2014.

C. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN m/m3)) 2012, with Editorial Revision (2015).

D. ASTM D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine 2011.

E. ASTM D6662 - Standard Specification for Polyolefin-Based Plastic Lumber Decking Boards 2017.

F. ASTM F1292 - Standard Specification for Impact Attenuation of Surfacing Materials Within the Use Zone of Playground Equipment 2017.

G. ASTM F1487 - Standard Consumer Safety Performance Specification for Playground Equipment for Public Use 2017.

H. ASTM F2075 - Standard Specification for Engineered Wood Fiber for Use as a Playground Safety Surface Under and Around Playground Equipment 2015.

I. AWPA U1 - Use Category System: User Specification for Treated Wood 2017.

J. CPSC Pub. No. 325 - Public Playground Safety Handbook 2010.

1.04 DEFINITIONS

A. Use Zone: The area beneath and immediately adjacent to a play structure or equipment (play event) that is designated for unrestricted circulation around equipment, and on whose surface it is predicted that a user would land when falling from or exiting the equipment.

B. Critical Fall Height: The maximum fall height at which the protective surfacing meets the requirements of ASTM F1292.

C. High Play Activity Area: Areas where the fall height is especially great, such as at swings. A high play activity area is defined only where the protective surfacing of the entire playground area is not designed for the greatest fall height. High play activity areas are defined on the drawings.

D. Fall Height: The vertical distance between the finished elevation of the designated play surface and the finished elevation of the protective surfacing beneath it as defined by ASTM F1487.

E. Protective Surfacing: Resilient ground surfacing. The characteristics of the protective surfacing are based on the fall height of the playground equipment. Changes in either the surfacing or the fall height, particularly reducing the resilience of the protective surfacing or increasing the fall height, will reduce safety-related performance.

F. Subbase: A layer under the resilient layer of the protective surfacing but over the subgrade; may be rigid, as in concrete or bituminous, or aggregate.

G. Subgrade: The surface of the ground on which the protective surfacing is installed.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements - Administrative Requirements, for submittal procedures.

B. Product Data: For all manufactured surfacing products, provide manufacturer's product data showing materials of construction, compliance with specified standards, installation procedures, and safety limitations.

1. Include IPEMA certifications where required.

2. Treated Wood Products: Provide information on wood treatment chemical content, toxicity level, and life-cycle durability.

C. Product Data: For natural surfacing materials, provide supplier's certification or mill certificate showing compliance with specified requirements.

D. Shop Drawings: Detailed scale drawings showing locations of existing playground equipment and exposed footings, bases, and anchorage points.

1. Clearly identify footing and base elevations in relation to a fixed survey point on site and to subgrade elevation and depth of protective surfacing, surveyed by land surveyor licensed in Maryland .

2. Show locations of underground utilities, storm-drainage system and irrigation system.

3. Show locations of related construction such as walkways and roadways, fences, site furnishings, and plantings.

4. Show measured fall height for each playground equipment item, determined in accordance with ASTM F1487.

5. Show Use Zone perimeters, determined in accordance with ASTM F1487.

E. Samples: For each product for which color must be selected provide color chart showing full range of colors.

F. Samples: Provide actual material samples for approval by Owner..

G. Percolation Test Report: Describing test method used and results.

H. Maintenance Data:

1. For manufactured surfacing products, provide manufacturer's recommended maintenance instructions and list of repair products, with address and phone number of source of supply.

2. For loose fill surfacing products, provide detailed re-ordering information to enable Owner to match installed material exactly.

I. Manufacturer's Field Report.

1.06 QUALITY ASSURANCE

A. Maintain one copy of the latest edition of ASTM F1487 and CPSC Pub. No. 325 at project site.

B. Manufacturer Qualifications: Company regularly engaged in manufacturing products specified in this section, with not less than three years of documented experience.

1. Surfacing installed in minimum 10 sites and been in successful service minimum 5 years.

2. Provide certificate of Insurance AA rated for minimum 1,000,000 dollars covering both product and general liability.

3. Manufacturer's Representative: Provide name, company name and address, and qualifications.

C. Installer Qualifications: Company certified by manufacturer for training and experience installing the protective surfacing; provide installer's company name and address, and training and experience certificate.

1.07 PRE-INSTALLATION MEETING

A. Coordinate with Section 11 6813.

B. Convene a meeting one week before starting earthwork for playground to discuss coordination between various installers.

1. Require attendance by personnel responsible for grading and installers of playground equipment, protective surfacing, footings, and adjacent work.

2. Include representatives of Contractor .

3. Notify Architect at least 2 weeks prior to meeting.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store protective surfacing to project site in accordance with manufacturer's recommendations.

B. Store materials in a dry, covered area, elevated above grade.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals - Closeout Submittals, for additional warranty requirements.

B. Provide minimum [Two] year warranty for playground surfacing.

PART 2 PRODUCTS

2.01 DESIGN CRITERIA

A. Because the safety of the playground depends on strict conformance to the design criteria, this information is provided for Contractor 's information.

1. The protective surfacing constitutes a resilient layer installed over a non-resilient layer, which is installed over the subgrade, with the top of playground equipment footings and anchorage devices covered by full depth of the resilient portion of the protective surfacing.

2. The total depth available for protective surfacing, from surface of subgrade, is indicated on drawings.

3. The top elevation of the protective surfacing is intended to be flush with adjacent grades.

4. Use Zone: The protective surfacing has been designed to provide acceptable impact attenuation as defined in ASTM F1292 for Critical Height of [six feet] feet ([1.8] m).
5. High Play Activity Area: The protective surfacing has been designed to provide impact acceptable attenuation as defined in ASTM F1292 for Critical Fall Height of [six feet] feet ([1.8] m).

B. If deviation from specified depth is required, it is the Contractor 's responsibility to make all changes required to maintain specified top elevation and required impact attenuation at no extra cost to Owner ; obtain approval prior to proceeding; follow approval request procedure as specified for substitutions.

2.02 MATERIALS

A. Poured-In-Place Membrane Surfacing: Weather-resistant wear layer over impact attenuating substrate over rigid subbase.

1. Wear Layer: Ethylene propylene diene monomer (EPDM) particles adhered with a ultraviolet-stabilized polyurethane binder to produce an even, uniformly colored surface.
2. Wear Layer Thickness: 3/8 inch (10 mm), minimum.
3. Coefficient of Friction, when wet: 0.8, minimum, when tested in accordance with ASTM D2047.
4. Wear Layer Color(s): As indicated on drawings.
5. Impact Attenuating Substrate: 100 percent recycled shredded styrene butadiene rubber (SBR) shreds or granules with 100 percent solids polyurethane binder to form a resilient material; do not use foam rubber.
6. Resilient Depth: As required to achieve specified Critical Fall Height as defined in ASTM F1292 but not more than depth indicated; maintain top elevation flush with adjacent grades.
7. Certification: Provide IPEMA certification of ASTM F1292 Critical Fall Height at thickness specified.
8. Manufacturers:
    a. GameTime, Inc: www.gametime.com/#sle.
    b. No Fault Sport Group; No Fault Safety Surface for Playgrounds: www.nofault.com/#sle.
    c. Play Safe Surfacing, Inc: www.playsafesurfacing.com/#sle.
    d. Hanover Specialties Inc: www.vitriturf.com/#sle.
    e. Substitutions: See Section 01 6000 - Product Requirements.
9. Accessories: Provide manufacturer's standard containment curbs and tapered transition elements to support surfacing between changes of surface grade.

B. Poured-In-Place Membrane Surfacing: Weather-resistant wear layer over rigid subbase.

1. Wear Layer: Ethylene propylene diene monomer (EPDM) particles adhered with a ultraviolet-stabilized polyurethane binder to produce an even, uniformly colored surface.
2. Wear Layer Thickness: 3/8 inch (10 mm), minimum.
3. Coefficient of Friction, when wet: 0.8, minimum, when tested in accordance with ASTM D2047.
4. Wear Layer Color(s): As indicated on drawings.
5. Manufacturers:
    a. No Fault Sport Group; No Fault Safety Surface for Waterplay: www.nofault.com/#sle.
    b. Substitutions: See Section 01 6000 - Product Requirements.

6. Accessories: Provide manufacturer's standard containment curbs and tapered transition elements to support surfacing between changes of surface grade.

C. Poured-In-Place Permeable Surfacing: Shredded rubber bonded with polyurethane adhesive, allowing water penetration, over aggregate subbase.

1. Rubber: 100 percent recycled shredded styrene butadiene rubber (SBR) shreds or granules.
2. Color: As indicated on drawings.
3. Resilient Depth: As required to achieve specified Critical Fall Height as defined in ASTM F1292 but not more than depth indicated; maintain top elevation flush with adjacent grades.
4. Certification: Provide IPEMA certification of ASTM F1292 Critical Fall Height at thickness specified.
5. Manufacturers:
    a. GameTime, Inc: www.gametime.com/#sle.
    b. No Fault Sport Group; No Fault Bonded Rubber Mulch Surfacing for Playgrounds: www.nofault.com/#sle.
    c. Play Safe Surfacing, Inc: www.playsafesurfacing.com/#sle.
    d. Substitutions: See Section 01 6000 - Product Requirements.
6. Accessories: Provide manufacturer's standard containment curbs and tapered transition elements to support surfacing between changes of surface grade.

D. Tile Surfacing: Factory-molded rubber tile with impact attenuating design and solid, uniform top surface, flat bottom and solid sides (dual durometer); adhered to a rigid subbase.

1. Tile Size: As indicated on drawings.
2. Coefficient of Friction, when wet: 0.8, minimum, when tested in accordance with ASTM D2047.
3. Resilient Depth: As required to achieve specified Critical Fall Height as defined in ASTM F1292 but not more than depth indicated; maintain top elevation flush with adjacent grades.
4. Color: As indicated on drawings.
5. Certification: Provide IPEMA certification of ASTM F1292 Critical Fall Height at thickness specified.
6. Manufacturers:
    a. Dinoflex; : www.dinoflex.com/#sle.
    b. GameTime, Inc: www.gametime.com/#sle.
    c. No Fault Sport Group; No Fault Safety Tile for Playgrounds: www.nofault.com/#sle.
    d. Surface America Inc: www.surfam.com/#sle.
    e. Ultimate RB: www.ultimaterb.com/#sle.
    f. Substitutions: See Section 01 6000 - Product Requirements.
7. Accessories: Provide manufacturer's standard containment curbs and tapered transition elements to support surfacing between changes of surface grade.

E. Recycled Rubber Fill: Loose fill; 100 percent recycled rubber chips, shreds, granules, or nuggets; installed over subgrade.

1. Chip Size: 3/8 inch, nominal (9 mm, nominal).

2. Depth: As required to achieve specified Critical Fall Height as defined in ASTM F1292 but not more than depth indicated; maintain top elevation flush with adjacent grades.
3. Color: Manufacturer's standard mixed colors.
    a. Selected color combination will average maximum 10 percent dark colors.
4. Certification: Provide IPEMA certification of ASTM F1292 Critical Fall Height at thickness specified.
5. Manufacturers:
    a. No Fault Sport Group; No Fault Loose Fill Rubber Mulch: www.nofault.com/#sle.
    b. Substitutions: See Section 01 6000 - Product Requirements.

F. Engineered Wood Fiber Fill: Manufactured for the purpose of protective surfacing; complying with ASTM F2075; do not use mulch manufactured from recycled pallets, or lumber containing nails or metal fasteners.
1. Depth: As required to achieve specified Critical Fall Height as defined in ASTM F1292 but not more than depth indicated; maintain top elevation flush with adjacent grades.
2. Certification: Provide IPEMA certification of ASTM F1292 Critical Fall Height at thickness specified.
3. Manufacturers:
    a. Fibar Systems: www.fibar.com/#sle.
    b. GameTime, Inc: www.gametime.com/#sle.
    c. Sof' Fall: www.sof-fall.com/#sle.
    d. Substitutions: See Section 01 6000 - Product Requirements.

G. Sand Fill: Uniformly graded (not "well graded"); washed; free of dust, clay, dirt, organic material, hazardous substances, and foreign objects; naturally or mechanically rounded particles; sieved in accordance with ASTM C136/C136M in the specified gradation range.
1. Percent Passing Sieve Size No. 8 (2.36 mm): 100 percent.
2. Percent Passing Sieve Size No. 16 (1.18 mm): 80 to 100 percent.
3. Percent Passing Sieve Size No. 30 (0.6 mm): 40 to 75 percent.
4. Percent Passing Sieve Size No. 50 (0.3 mm): 0 to 25 percent.
5. Percent Passing Sieve Size No. 100 (0.15 mm): Less than 2 percent.
6. Depth: As indicated on drawings.

H. Gravel Fill: Pea gravel or other rounded gravel; washed; free of dust, clay, dirt, organic material, hazardous substances, or foreign objects; rounded particles, either naturally or mechanically; sieved in accordance with ASTM C136/C136M in the specified gradation range.
1. Percent Passing Sieve Size 1/2 inch (12.5 mm): 100 percent.
2. Percent Passing Sieve Size 3/8 inch (9.5 mm): 75 to 85 percent.
3. Percent Passing Sieve Size No. 4 (4.75 mm): 0 percent.
4. Depth: As indicated on drawings.

I. Wood Mulch Fill: Untreated chipped bark or untreated chipped tree prunings; free of sharp or foreign objects or toxic chemicals; free of twigs, leaves, branches, thorns, dirt, grass, yard clippings, soil, or

poisonous plants; do not use mulch manufactured from recycled pallets, or lumber containing nails or metal fasteners.

1. Chip Length: 1-1/2 inches (40 mm), maximum.
2. Depth: As indicated on drawings.

J. Geotextile Fabric: Nonwoven polypropylene sheet.

K. Containment Curbs: Cast-in-place concrete; free of sharp vertical edges, protruding elements, and trip hazards.

1. Size(s): As indicated on drawings.
2. Minimum Edge Radius: 1/2 inch (13 mm).

L. Rigid Subbase: Concrete; ready mix concrete in accordance with ASTM C94/C94M; strength of 3,000 psi (20.7 MPa) at 28 days.

M. Rigid Subbase: Bituminous, as specified in Section 32 1216.

N. Aggregate Subbase: As specified in Section 32 1123.

PART 3 EXECUTION

3.01 PREPARATION FOR REPLACEMENT OF EXISTING LOOSE FILL SURFACING

A. Remove existing loose fill.

B. Measure the location of all playground elements, including perimeter of existing protective surfacing, access and egress points, hard surfaces, walls, fences, and structures, and planting locations.

C. Stake the layout of the entire Use Zone perimeter before starting any work, based on contract documents.

1. Verify that Use Zone perimeters do not overlap hard surfaces, whether currently installed or not.
2. If overlaps exist, notify Architect .
3. Do not proceed until revised drawings have been provided, showing corrected layout.

D. Inside Use Zones remove all obstructions that would extend into the resilient protective surfacing.

E. Make surface of subgrade smooth and evenly sloped.

1. Fill holes and depressions with borrow from same area or soil of similar type.
2. Make changes to grades as indicated on drawings.

F. After subgrade is correct, mark intended depth of surfacing on the base supports of each item of playground equipment using paint or tape in a manner that will be easily verifiable during installation of surfacing.

G. Perform percolation test at the lowest elevation of the subgrade in the areas to be covered by protective surfacing.

1. Report results to Architect .
2. If percolation is less than 1 inch (25 mm) in a 3 hour period, do not proceed.

3.02 EXAMINATION

A. Playground equipment installer will perform playground layout prior to installation of footings; verify correctness of layout before starting this work.

B. Verify that playground equipment and site furnishings and irrigation system located within playground area are complete.

C. Verify location of underground utilities and facilities in the playground area. Damage to underground utilities and facilities will be repaired at Contractor 's expense.

D. Verify that subgrades are at proper elevations and that smooth grading is complete.

E. Verify that proper depth of surfacing is marked on base supports of playground equipment.

3.03 PREPARATION

A. Correct subgrade irregularities to ensure that required depth of protective surfacing can be installed, and subgrade elevation is in accordance with manufacturer's requirements.

B. Inside Use Zones remove all obstructions that would extend into the resilient protective surfacing.

C. Remove rocks, debris, and other similar items.

D. Install containment curbs with top surface flush with intended elevation of top surface of protective surfacing.

3.04 SUBBASE

A. Install aggregate subbase as indicated on drawings and in Section 32 1123. Compact aggregate to maximum 95 percent, in accordance with ASTM D1557.

B. Install concrete subbase as indicated on drawings and in Section 03 3000.

1. Thickness: 4 inches (100 mm).
2. Remove curing compounds and other substances that will adversely affect adhesion.

C. Install bituminous subbase as indicated on drawings and in Section 32 1216.

D. Install with top surface of subbase no higher than grades and levels indicated and not more than 1/4 inch (6 mm) lower than grades and levels indicated.

E. Install in true, even plane, sloped to provide positive drainage.

F. Flatness Tolerance: 1/4 inch in 10 feet (6 mm in 3 m), maximum.

G. Cure subbase at least 7 days but not less than required by manufacturer of resilient surfacing.

3.05 RESILIENT SURFACING LAYER

A. Install in accordance with CPSC Pub. No. 325, ASTM F1487, manufacturer's instructions, and requirements of authorities having jurisdiction (AHJ).

B. Install proper thickness throughout Use Zone(s).

C. Clean and dry surface of subbase.

D. Cover aggregate subbase with geotextile fabric:

1. Verify that aggregate is free of ruts or protruding objects.
2. Lap minimum 4 inches (100 mm) width at seams. Adhere seams in accordance with manufacturer's recommendations.
3. Install fabric smooth, and free of tensile stresses, folds, or wrinkles.
4. Protect fabric from clogging, tears, or other damage during surfacing installation.
5. Repair or replace damaged fabric in accordance with manufacturer's recommendations.

E. Poured In Place Surfacing:

1. Mix components mechanically on-site in accordance with manufacturer's directions; do not mix by hand.
2. Install seamlessly; ensure complete bond to subbase.
3. Cover footings and foundations and adhere tightly around penetrating elements.
4. Maintain full thickness of resilient layers within Use Zone; cover or abut containment curbs as indicated on drawings; completely cover tapered transition edges.
5. Hand trowel exposed surface to smooth, even finish.
6. Impact Attenuation Layer: Install entire layer in one continuous pour on the same day.
7. Wear Surface: Bond wear surface to substrate with adhesive. Apply adhesive in small quantities so that wear surface can be applied before adhesive dries.
    a. Install surfacing seamlessly. When wear surface is composed of different color patterns, pour surface continuously and seamlessly.
    b. When seams are required due to color change or field conditions, place adjacent wear surface as soon as possible, before initial pour has cured. Coat edge of initial pour with adhesive and apply wear surface mixture immediately.
    c. Add a minimum of 1/16 inch (2 mm) depth to specified surfacing depth to ensure required impact attenuation performance is met.
    d. Install wear surface to cover foundations and adhere tightly around elements penetrating the surface.

F. Tiles: Lay tile with cut end tiles of equal width.
1. Bond tile to substrate with adhesive recommended by manufacturer.
2. Make cutouts around equipment not more than 3/8 inch (10 mm) in width; remove and refit tile as required to reduce gaps.
3. Fill and seal gaps around equipment with sealant.

3.06 LOOSE FILL SURFACING

A. Install in accordance with CPSC Pub. No. 325, ASTM F1487, and requirements of authorities having jurisdiction (AHJ).

B. Cover Subgrade with Geotextile Fabric:
1. Lap minimum 4 inches (100 mm) width at seams. Adhere seams in accordance with manufacturer's recommendations.
2. Install fabric smooth, and free of tensile stresses, folds, or wrinkles.
3. Protect fabric from clogging, tears, or other damage during surfacing installation.
4. Repair or replace damaged fabric in accordance with manufacturer's recommendations.

C. Install loose fill to depths indicated, with smooth even surface flush with tops of containment curbs.

D. Sand: Determine finished elevation after sand has been settled with water and percolating.

3.07 FIELD QUALITY CONTROL

A. Obtain the services of the equipment manufacturer's field representative to review the finished installation for compliance with specified requirements and with design criteria to the extent known to the Contractor ; submit report of field review.

B. Owner or Owner 's representative will inspect playground surfacing after installation to verify that surfacing is of proper type and depth and that playground meets specified design safety and accessibility requirements.

C. Repair or replace rejected work until compliance is achieved.

3.08 CLEANING AND PROTECTION

A. Restore adjacent existing areas that have been damaged from the construction.

B. Clean playground equipment of construction materials, dirt, stains, filings, and blemishes due to shipment or installation. Clean in accordance with manufacturer's instructions, using cleaning agents as recommended by manufacturer.

C. Clean playground area of excess construction materials, debris, and waste.

D. Remove excess and waste material and dispose of off-site in accordance with requirements of authorities having jurisdiction.

E. Protect installed products until Date of Substantial Completion.

F. Replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 32 1822
TENNIS COURT SURFACING AND NETS

PART 1 – GENERAL:

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions and Supplementary Conditions and Division 1 through Division 16 Specification Sections, apply to work of this Section.

1.02 RELATED WORK

A. Section 32 12 16– Hot-Mixed Asphalt Paving

B. Section 32 31 13 - Chain Link Fences and Gates

1.03 REFERENCE STANDARDS

A. Applicable standards and details of the Maryland Department of Transportation "Standards and Specifications."

1.04 WORK DESCRIPTION

A. Construct tennis courts as indicated on Drawings, in number, size, and locations as shown. Work of this Section shall include the following:

1. Preparation of the base pavement section for tennis courts shall be as indicated on the Plans and as specified in Section 32 12 16.
2. Construction of court surface including game lines, net posts and footings and nets.
3. Existing perimeter court fencing shall be treated as indicated, and is covered under Section 32 31 13. Coordinate court surface installation with treatment of existing fencing posts and installation of new fencing mesh.1.

B. Court surfaces shall be uniform in texture and color, in accordance with grades, cross sections and pitch required by drawings, and free of all depressions and ridges.

1.05 SUBMITTALS

A. Submit court surface manufacturer's product data, catalog cuts, application specifications, maintenance information, and office samples.

1.06 QUALITY ASSURANCE

A. The installer of the court surfacing shall be certified by the approved manufacturer, and shall use only workmen who are trained and experienced in the installation of the court surface.

B. Do not store resurfaces or color system materials in direct sunlight. During cold weather, store materials in a manner to prevent freezing. All materials shall be kept sealed in original containers until ready for use.

1.07 WARRANTY

A. Provide minimum one (1) year warranty, commencing from date of owner acceptance, covering materials and installation. Contractor shall repair or replace defective surface, at no cost to owner, during the warranty period.

PART 2 – PRODUCTS:

2.01 GENERAL

A. Court Surfacing:

1. Approved Manufacturer: "Latex-ite" asphalt resurfacer,“ Latex-ite” crack and leveling compound and "Latex-ite" acrylic color sealer, as manufactured by American Tennis Courts, Inc., Baltimore, Maryland, 1.410.477.4400, or pre-bid approved substitution.

B. Tennis net posts: 2 7/8" O. D. galvanized steel posts with "dark green" epoxy finish and heavy duty external take-up winding device, equipped with quick release, detachable winding handle.

1. Approved manufacturer: "Super Pro Deluxe" by American Tennis Courts, Inc., or pre-bid approved substitution.

C. Tennis net tie down: As manufactured by American Tennis Courts, Inc., or pre-bid approved substitution.

D. Tennis nets: Double synthetic spun polyester headband, quadruple sewn to a braided polyethylene body, with black vinyl side pockets, double sewn bottom band, and incorporating spur grommets and fiberglass dowels. Net shall not crack, yellow, pink, face, or show effects from acid rain. Net shall remain pliable in cold weather. Net dimensions: 41'-9" long x 3'-3" high.

1. Netting: Single twine mesh, made from heavy-duty 3mm black braided polyethylene, with minimum B/S of 285 pounds. Mesh shall be 1-3/4" square.

2. Cables: 6mm diameter PVC coated wire, with mechanically spliced double loops.

3. Dowels: 10mm diameter polished fiberglass.

4. Grommets: Nickel-plated brass, spur type.

E. Windscreens: Open mesh polypropylene, minimum 75 percent blockage, with reinforcing center tape and vinyl-coated steel wire rope. Reinforced hems and brass grommets spaced at 12 inches on center, top and bottom. Height shall be 9 feet, color shall be dark green.

F. Game Lines: Two (2) inch wide white lines, 100% acrylic game line paint. Oil base paint or lacquer is not acceptable.

G. Court surface base: Refer to Section 32 12 16, Hot-Mixed Asphalt Paving, and as indicated on the Contract Drawings.

H. Concrete for footings and anchors: MDOT-SHA Class "3", 3500 PSI.

I. Tennis Backboard: Provide tennis backboard, 10 feet high by 16 feet wide (four 4 foot wide panels). Backboard shall be constructed of solid U.V. stabilized, plastic sheet, with corrosion resistant mounting hardware. Provide mounting hardware to suit project conditions. Color of each panel shall be green with a horizontal with “net” stripe.

PART 3 – EXECUTION:

3.01 INSPECTION

A. Examine the areas and conditions under which the Work of this Section shall be installed. Correct conditions detrimental to the proper condition of the Work. Do not proceed until unsatisfactory conditions have been corrected.

B. Do not install court surfacing when the ambient temperature is below 50□F or above 140□F. Do not apply when rain is imminent.

3.02 PREPARATION

A. Prepare base pavement section for tennis courts as indicated on the Plans and as specified in Section 32 12 16. Base shall be allowed to cure for a minimum of fourteen (14) days prior to the application of court surfacing.

B. Net posts, footings, and tie-downs shall be installed prior to placing the Superpave base course. Footings shall be held 2" below finish grade, with top of sleeves extending to finish grade.

C. Prior to applying court surfacing, flood court area with water. Allow water to stand for one (1) hour at a minimum temperature of 75□ with sun. Any areas exhibiting standing water or "birdbaths" over 1/16" in depth shall be marked for patching. Patch areas as follows:

1. Using a straightedge of sufficient length to bridge the low area, screed an application of "Latex-ite" Resurfacer or Crack and Leveling Compound, or comparable compound recommended by a pre-bid approved manufacturer.
2. After patching has cured, check patched area with a stringline to insure that the area has been brought flush with surrounding surface.
3. Roller marks: Apply asphalt patching and leveling compound along roller marks and feather with a squeegee.

D. After patching, completely clean court base surface by means of high powered blowers, removing all dust, dirt and debris, and leaving areas completely dry.

3.03 COURT SURFACING

A. Apply one (1) application of asphalt resurfacer at the rate of 0.12 gallons per square yard (undiluted form). Mix resurfacer with potable water at the rate recommended/specified by the manufacturer. Allow material to cure at least twenty-four (24) hours prior to application of color coats.

B. Color coats: Apply acrylic color sealer in three (3) applications for a total of 0.15 gallons per square yard (undiluted form). Mix color sealer with 80-100 mesh silica sand and potable water at rates specified by the manufacturer. Courts shall be thoroughly scraped between color sealer applications to remove ridges. Apply succeeding coat only after preceding coat has thoroughly dried (2-3 hours).

1. Colors shall be selected by the Architect.

C. Game Lines: Apply marking paint only after the color sealer has completely cured (two (2) to four (4) days depending on conditions). Accurately locate and mark game lines by snapping chalk lines. Use soft-soled shoes and kneepads to prevent surface indentation during marking and painting operations. Uneven line width and undulating or ragged line work shall be rejected.

3.04 FOOTINGS, NET POSTS, AND FIXTURES

A. Footings: Footings shall be two (2) feet by two (2) feet by three (3) feet in depth, except they shall be belled at the bottom a minimum of 30".

B. Ground sleeves shall be schedule 40 PVC pipe, 24" long, six (6) inches above the top of the 2" base course.

C. Tie downs: Install center tie-down anchors, compatible with nets. Anchors shall be set in twelve (12) inch by twelve (12) inch by twelve (12) inch deep footings. Top of footings shall protrude four (4) inches above the top of the 2" base course.

3.05 NETS AND ACCESSORIES

A. Install nets and winding devices in accordance with manufacturer's written instructions.

3.06 WINDSCREENS

A. Install windscreens in accordance with manufacturer’s written instructions. Assure that windscreens are installed tight and secure.

3.07 TENNIS BACKBOARD

A. Install backboard in accordance with manufacturer’s written instructions. Assure that backboards are installed tight and secure.

3.08 PROTECTION

A. Protect tennis court surfaces, posts, tie downs, nets and winding devices from damage by work of other trades until accepted by owner.

3.09 CLEAN-UP

A. Remove all excess materials and debris associated with the Work of this Section from the project area and legally dispose of offsite.

END OF SECTION

SECTION 32 1823.39
SYNTHETIC RUNNING TRACK SURFACING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Synthetic running track surfaces.

B. Line markings.

1.02 RELATED REQUIREMENTS

A. Section 31 1000 - Site Clearing.

B. Section 31 2000 - Earthmoving.

C. Section 32 1216 - Asphalt Paving.

D. Section 32 1313 - Concrete Paving.

E. Section 32 1813 - Synthetic Grass Surfacing.

F. Section 31 2200 - Grading: Excavation, backfill and compaction required for installation of synthetic running track surfacing.

G. Section 33 4100 - Subdrainage.

1.03 REFERENCE STANDARDS

A. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness 2015e1.

B. IAAF/NCAA - Performance Specification for Synthetic-Surfaced Athletics Tracks (Outdoor) 1999.

C. DIN 4102-1 - Fire Behaviour of Building Materials and Building Components - Part 1: Building materials; concepts, requirements and tests 1998.

D. DIN 18035 6 - Sporting Grounds Part 6-Synthetic Surfaces 2008.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to start of work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's product data including standard specifications, installation guidelines and maintenance instructions.

1. Submit documentation that synthetic running track surfacing material is free of toxic or hazardous substances that exceed the limits set forth by the U.S. Environmental Protection Agency.

C. Shop Drawings: Show location and color of lane lines, start lines, finish lines, and related markings for Owner to review a minimum of 4 weeks prior to application.

D. Samples: Three, 12 inch by 12 inch (305 mm by 305 mm) samples of the full-depth system in the color(s) indicated on the contract documents.

E. Certifications:

1. Submit installer's certification that the installer has reviewed the asphalt or concrete base drawings and specifications and accepts the asphalt or concrete base will be suitable if constructed as indicated and specified.

2. Submit installer's certification that in-place concrete or asphalt substrate is acceptable as installed.
3. Submit certification from registered engineer or land surveyor that synthetic running track surface layout and dimensions are as shown on drawings.

F. Test Reports: Reports of field quality control testing.

G. Manufacturer's Instructions: Submit copies of manufacturer's written installation instructions and other recommendations

H. Manufacturer's Qualification Statement.

I. Installer's Qualification Statement.

J. Maintenance Data.

K. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner 's name and registered with manufacturer.

L. Project Record Documents: Record actual locations of installed synthetic running track surfaces.

1.06 QUALITY ASSURANCE

A. The synthetic surfacing contractor shall furnish all labor, materials, equipment, supervision and services necessary for the proper completion of the synthetic track surfacing and related work indicated on the drawings and specified herein. The synthetic surfacing contractor shall refer to the drawings for the required locations of synthetic track surfacing to be installed. All quantities and dimensions shall be field verified by the synthetic surfacing contractor.

1. Install an IAAF approved, full depth poured-in-place two components, UV stabilized elastomeric polyurethane Dual Durometer synthetic surfacing system with embedded textured finish

B. Manufacturer Qualifications: Company that has produced surfacing materials for not less than ten years with not less than five similar projects that have been in successful use for more than five years.

1. The manufacturer must have a minimum of 10 years of experience with compound two part polyurethane for athletic surfaces.
2. The Manufacturer must offer a minimum of four (4) IAAF Certified Track Systems.
3. Layout and paint all track lines and event markings as required.
4. Coordination - The synthetic surfacing contractor shall coordinate the work specified with an authorized and appointed representative of the owner so as to perform the work during a period and in a manner acceptable to the owner.

C. Installer Qualifications: Minimum five years experience in successful installation of surfacing systems of type specified herein.

1. Submit manufacturer's certification that installer is qualified to install the products specified.
2. Submit installer's certification that installer is a member of American Sports Builders Association (ASBA).
3. Submit installer's certification that installer employs at least one ASBA “Certified Track Builder” (CTB) on installation team for project.
4. The Contractor must have a minimum of 7 years’ experience in the installation of poured-in- place, two-component elastomeric polyurethane synthetic track surfacing.

5. The contractor must have installed a minimum of 6 outdoor track facilities in the last 2 years using the exact, IAAF certified, poured-in-place, two-component elastomeric polyurethane synthetic track surfacing, as specified herein with the contractor bidding this project.
    a. Provide list of a minimum of 10 total IAAF/NCAA certified installations utilizing the same product specified.

D. Applicable Publications - Codes and standards follow the current guidelines set forth by the International Amateur Athletic Federation (IAAF) and the National Collegiate Athletic Association (NCAA), along with the current material testing guidelines as published by the American Society of Testing and Materials (ASTM).

E. Performance Standards

1. The new synthetic track surfacing system shall exhibit the following minimum performance standards as required by IAAF:

1.07 DELIVERY STORAGE AND HANDLING

a. Thickness Average: ≥ 13mm Minimum - 10mm

b. Force Reduction: 35 to 50

c. Modified Vertical Deformation: 0.6 to 1.8

d. Friction: TRRL Skid Resistance ≥ 47

e. Tensile Strength: ≥ 0.5

f. Elongation at break: ≥ 40

B. Track Surface System Packaged Materials: Deliver packaged materials in original, unopened containers showing name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.

C. Store in weathertight location and protect from damage during delivery, storage and handling.

1.08 PROJECT CONDITIONS

A. Weather Limitations: Proceed with track surface installation only when existing and forecasted weather conditions permit installation to be performed to ensure beneficial and optimum results are obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a five year period after date of Substantial Completion.

C. Provide five year manufacturer warranty for synthetic running track surface system.

PART 2 PRODUCTS

2.01 SYNTHETIC RUNNING TRACK SURFACING

A. A.Basis of design product: BSS 1000, 13mm manufactured by Tarkett Beynon. Substitutions shall be approved in writing by PGCPS.

B. Synthetic Running Track Surfacing System: Permeable; paved-in-place.

1. System Thickness: 1/2-inch thick (13 mm).

2. Base Layer: Paved-in-place base layer of Type 2 base layer recycled SBS rubber granule and polyurethane binder.

3. Finish Layer: Structural spray coating of colored polyurethane and Type 2 top layer EPDM rubber granule mixture, sprayed onto base system.
4. Comply with the following as described in IAAF/NCAA Performance Specification for Synthetic-Surfaced Athletics Tracks (Outdoor):
    a. Force Reduction: 35 to 50 percent.
    b. Modified Vertical Deformation: 0.23 inch to 0.07 inch (0.6 mm to 1.8 mm).
    c. Friction (TRRL Skid Resistance): 47.
    d. Tensile Strength:
        1) Porous surface: 72.5 pound per square inch (0.5 MPa).
        2) Non-porous surface: 58 pounds per square inch (0.4 MPa).
    e. Elongation at Break: 40 percent.
    f. Maximum Rubber Content in Force Reduction Layer: 20 percent.
5. Comply with the following as described in DIN 18035 6:
    a. Spike Resistance: Class 1.
    b. Ball Rebound: 99 percent.
    c. Abrasion Resistance: 1.30.
    d. Maximum Indentation: 7/32 inch (5.7 mm).
    e. Sliding Coefficient:
        1) Dry: 0.68.
        2) Wet: 0.50.
6. Flammability Behavior: Class 1 in accordance with DIN 4102-1.

2.02 MATERIALS

A. Elastomeric Polyurethane: A.Beypur, the two-component U.V. stabilized elastomeric polyurethane compounded from polyol and isocyanate components, based on one hundred percent Methylene Diphenyl Isocyanate (MDI). No Toluene Disocyanate Isocyanate (TDI) will be allowed.

B. Polyurethane Primer: Single-component, designed specifically for use in priming concrete, asphalt or existing, cured polyurethane prior to installation of new polyurethane coating.

C. Polyurethane Coating: 2-component, self-leveling, colored, polyurethane coating (polyol and isocyanate) containing no solvents, toluene diisocyanate (TDI), or mercury.

D. Polyurethane Binder: Single component, 100 percent polyurethane, moisture curing, middle viscosity binding agent based on diphenylmethane diisocyanate (MDI)/TDI, containing less than 0.5 percent of TDI monomer, with no solvents or extenders (plasticizers).

E. Polyurethane Pore Filler: 2-component thixotropic colored polyurethane containing no solvents, TDI, or mercury.

F. Structural Spray Coat: 2-component polyurethane spray coating.

G. Aliphatic Top Coating: 2-component, high elongation, UV resistant sealer.

H. Base Layer Granules, Type 1: Low-density, colored EPDM rubber granules, processed and graded to 3/64 inch (1 mm) to 3/32 inch (3 mm) in size, containing less than 4 percent dust.

1. Granulates shall be peroxide cured.
2. The EPDM granulates and the U.V. stabilized elastomeric polyurethane shall be color matched.

I. Top Layer Granules, Type 2: Colored, virgin EPDM rubber granules, processed and graded 1/64 inch (0.5 mm) to 1/16 inch (1.5 mm) in size unless otherwise specified. Provide rubber containing minimum of 20 percent EPDM and approved by resin manufacturer.

1. Specific Density: 1.60 plus or minus 0.08.
2. Hardness of 60 when tested in accordance with ASTM D2240, Shore A.

J. Rubber Dust: Residual product made from excess top layer granules in size of 0.0 inch (0.0 mm) to 1/64 inch (0.5 mm).

K. Rubber Granulate

1. Fine mesh Styrene Butadiene Rubber (SBR) processed ground to a graded size not to exceed 20 mesh in size.
2. A maximum of twenty percent, by weight of the SBR will be allowed in the force reduction layer.

2.03 ACCESSORIES

A. Track and Event Line Marking Paint: Polyurethane paint formulated for exterior service environments in striping applications in color as specified for line markings.

1. Thickness: 12 mils (0.3 mm) dry film thickness (DFT).
2. Multiple coats to achieve thickness as required by paint manufacturer.
3. Prime surface to achieve adhesion characteristics of paint.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Do not proceed until unsatisfactory conditions have been corrected.
2. Installation shall not take place if adjacent or concurrent construction generates excessive dust,
3. abrasives or any other byproduct that, in the opinion of the installer, would be harmful to the track material, until completion of such works.
4. Substrate tolerances:
5. If, in the opinion of the installer of the synthetic material, the weather and/or climatic conditions are detrimental to the proper installation of the surfacing materials, work shall be delayed until conditions are acceptable.
6. Preferred installed temperature is 50 degrees Fahrenheit and rising. Installation shall be executed only in dry conditions.
    a. Planarity: Not to exceed 1/4 inch (6 mm) in 10 feet (3.048 m), non-cumulative.
    b. Levelness: Not to exceed 0.1 percent in running direction.
    c. Concrete Curbs: Ensure top elevations of continuous concrete curbs are at constant elevation.

B. Flood Test: Flood substrate immediately after substrate is capable of supporting foot traffic. Allow to dry for 20 minutes.

1. If any areas of ponded water (“birdbaths”) are visible at the end of the 20 minute drying time, correct areas of substrate that allow water to pond.
2. Obtain Architect 's written approval of method of correction prior to proceeding with corrective work.
3. Cold tar patching, skim-coat patching and sand-mix patching are not acceptable methods of correction.

3.02 PREPARATION

A. Protection: Protect surfaces adjacent to track surfacing operations from polyurethane liquids.

B. Surface Preparation: Verify substrate is fully cured and free from excess surface oils and chemicals that would impair track surface installation.

1. Concrete: Cure concrete for not less than 45 days. Test cured concrete substrate and provide documentation that moisture content is within limits defined by manufacturer.
2. Asphalt: Cure asphalt for no less than 28 days. Test cured asphalt and provide documentation that volatiles and latent asphalt content are within limits defined by manufacturer.

C. Ensure that asphalt compaction tests indicate compaction of 95 percent or greater. Check asphalt with 10 foot (3.048 m) straightedge in all directions. Repair areas not in conformance or replace with new materials, recompact, and recheck surfaces.

D. Subbase:

1. The synthetic track surfacing system shall be laid on an approved subbase. The General Contractor shall provide compaction test results of 95% or greater for the installed subbase and asphalt surface.
2. The track surface, i.e. asphalt substrate, shall not vary from planned cross slope by more than + .2%, with a maximum lateral slope outside to inside of 1%, and a maximum slope of 0.1% in any running direction. The finished asphalt shall not vary under a 10' straight edge more than 1/8”.

3.03 INSTALLATION

1. It should be the responsibility of the asphalt paving contractor to flood the surface immediately after the asphalt is capable of handling traffic, but within 24 hours. If, after 20 minutes of drying time, there are birdbaths evident, it shall be the responsibility of the architect, in conjunction with the surfacing contractor, to determine the method of correction. No cold tar patching, skin patching or sand mix patching will be acceptable.
2. Any oil spills (hydraulic, diesel, motor oil, etc.) must be completely removed and replaced with either polyurethane or new, keyed in asphalt. The minimum curing time for the asphalt base is 28 days. It shall be the responsibility of the surfacing contractor to determine if the asphalt substrate has cured sufficiently prior to the application of the polyurethane surfacing system.
3. It shall be the responsibility of the general contractor to determine if the asphalt substrate meets all design specifications, i.e. cross slopes, planarity and specific project criteria. After all the above conditions are met, the synthetic surfacing contractor must, in writing, accept the planarity of the asphalt receiving base, before work

B. General:

1. Comply with manufacturer's recommendations.
2. Prime areas to be surfaced.
3. Make substrate surface repairs and minor planarity corrections with repair compound.

4. Install track surface as specified to achieve track surface performance and physical dimensions within tolerances.
5. Total thickness of the BSS 1000 Dual Durometer synthetic track surfacing system shall average 13mm.
6. Equipment:
    a. The BSS 1000 Dual Durometer synthetic track surfacing system components shall be processed and installed by specially designed machinery with automatic electronic portioning, which provides continuous mixing, feeding and finishing for accurate quality controlled installation.
    b. No hand mixing will be allowed.
7. Materials
    a. Force Reduction Layer – The fine mesh SBR granules and UV stabilized elastomeric polyurethane shall be metered and mixed together on site to regulate the ratio/quantity of SBR, not to exceed fourteen percent in the system and to insure an even distribution of the granules throughout the 8mm force reduction layer. No multi-layered system allowed.
    b. Resilient Wearing Layer - The 1 to 3 millimeter EPDM granules shall be mechanically integrated with an UV stabilized elastomeric polyurethane to the full depth of the 5mm wearing layer. The resilient textured finish shall be a dense matrix of embedded EPDM granules.

3.04 INSTALLATION OF PAVED-IN-PLACE SYNTHETIC TRACK SURFACE

A. Priming: Prime only area to be covered within working day to ensure good bond to base. Apply primer at manufacturer's recommended rate.
    1. Asphalt: Prime asphalt substrates with mixture of one part polyurethane binder and on part butyl acetate.
    2. Concrete: Prime concrete substrates with mixture of one polyurethane binder and one part polyurethane primer.

B. Base Layer: Mix base layer granules with polyurethane binder at manufacturer's recommended rate until homogeneous. Pave mixture in place using heated mechanical screed paver specially designed for this work. Apply to recommended depth at recommended application rate.

C. Spray Coat: Apply spray coat with air and volume controlled spray equipment in even surfaces without streaking. Apply second coat in opposite direction to first application. Achieve uniform finish. Apply at manufacturer's recommended rate.

D. Seal Coat: Seal base layer by scraping thixotropic mixture of pore filler and rubber dust onto surface. Inspect sealed surfaces for pinholes prior to further application. Apply at rates recommended by material manufacturer.

E. Top Layer: Apply multiple-spray application of mixed polyurethane coating and top layer granules, mixed and applied at rates recommended by product manufacturer, to achieve resilient texture finish comprising of dense matrix of encapsulated granules.

F. Seal Coat: Seal base layer by scraping thixotropic mixture of pore filler and rubber dust onto surface to render it impermeable. Inspect sealed surfaces for pinholes prior to further application. Apply at rates recommended by material manufacturer.

G. Spray Coat: Apply spray coat with air and volume controlled spray equipment. Apply spray coats resulting in even surfaces without streaking. Apply second application in opposite direction to first application. Achieve uniform finish. Apply at manufacturer's recommended rate.

3.05 INSTALLATION OF FULL-POUR SYNTHETIC TRACK SURFACE

A. Base Layers: Apply two coats of double-mixed polyurethane coating at approximately manufacturer's recommended rate with notched squeegee. After material has self-leveled and is still liquid, broadcast Type 2 base layer granules into surface to excess. After curing (hardening), remove excess granules for reuse. Then apply third layer of polyurethane coating with flat squeegee to fill open areas between embedded granules.

B. Top Layer: Apply multiple-spray application of mixed polyurethane coating and Type 2 top layer granules, mixed and applied at rates recommended by product manufacturer, to achieve resilient texture finish comprising of dense matrix of encapsulated granules.

C. Seal Coat: Spray-apply aliphatic top coating in two coats applications onto exposed top layer. Apply second application in opposite direction to first application to achieve uniform finish.

3.06 TRACK AND EVENT LINE MARKING

A. Track and Event Line Markings, General: Comply with the requirements of the referenced IAAF / NCAA standards.

B. Provide IAAF / NCAA standard markings for the following track and field events:

1. 100 m.
2. 200 m.
3. 400 m.
4. 800 m.
5. 1000 m.
6. 1500 m.
7. 1 mile.
8. 2000 m.
9. 3000 m steeplechase.
10. 100 m hurdles.
11. 110 m hurdles.
12. 400 m hurdles (men and women).
13. 4 by 100 m relay.
14. 4 by 200 m relay (completed in lanes).
15. 4 by 400 m relay.
16. 4 by 800 m relay.
17. 4 by 1500 m relay.
18. Other events defined by Owner.
19. NCAA events.

3.07 TOLERANCES

A. Percent Granules: Variation of plus or minus 2 percent.

B. Surface Thickness, variation: Variation of minus 0.0 inch (0.0 mm) to plus 1/8 inch (3.0 mm).

C. Color Deviation: 5 Delta E (Hunter) units maximum allowed.

D. Slopes:

1. Track Oval:

a. Running Direction: 1.0 percent, maximum.

b. Lateral Slope: 1.0 percent maximum.

2. High Jump (“D” area): 1.0 percent maximum, downwards to the cross bar.

3. Run Ups: Same as track oval unless located in the High Jump (“D”) area.

3.08 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional information.

B. Tests: Perform thickness, hardness and deformation tests. Employ an Independent Testing Laboratory for the purpose. Submit reports.

1. Conduct 60 thickness test spaced throughout the track surface.

2. Conduct 5 hardness and deformation tests.

C. Layout:

1. Employ registered surveyor to document compliance of in-place work with the contract documents and the referenced standards.

2. Submit reports.

3.09 CLEANING

A. Leave surfacing in clean condition and free of surface defects.

B. Reapply and touch up paint striping once during the warranty period.

C. Promptly remove debris created by track work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking debris onto roads, walks, or other paved areas.

D. Dispose of all materials off site in proper manner.

3.10 PROTECTION

A. Protect installed surfacing from damage during the balance of construction activity.

END OF SECTION

SECTION 32 1823
SAND-RUBBER SYNTHETIC TURF SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

B. National Federation Football Rules and Interpretations; FIFA Rules.

C. National Federation of State High School Associations

D. State of Maryland High School League

1.02 SUMMARY

A. Approved manufactures that may be considered with comparable systems as approved by the owner and shall meet the speciedd requirements outline herein: Fieldturf, Shaw Sports Turf, Astroturf.

B. Furnish all labor, materials, tools and equipment necessary to completely install all new synthetic turf as indicated on the plans and as specified herein. The installation of all new materials shall be performed in strict accordance with the manufacturer's installation instructions and in accordance with all approved shop drawings.

C. Regardless of the turf system proposed, each system shall meet or exceed the requirements of this specification related to performance and qualifications, and particularly with regard to fiber length and infill composition.

D. Furnish and install a multi-purpose Infilled Synthetic Turf System.

E. Provide tufted and inlaid lines and markings or other such graphics as described herein and as shown on the Drawings and approved Shop Drawings.

F. Provide all attachments and penetrations as required to complete the work as shown on the Drawings and approved Shop Drawings.

G. Provide an eight (8) year standard, non-prorated warranty for all Infilled Synthetic Turf components and installation. Provide a Third Party Insured Warranty as described herein for Synthetic Turf System.

H. Provide Owner with video taped on site field maintenance training, manuals, schedules and equipment.

1.03 SUBMITTALS

A. All submittals shall be directed to the Owner for distribution. The contractor may send electronic submittals where applicable.

B. Submit the following with the Bid/Proposal:

1. Submit two samples, 12x12 inch in size, illustrating details of finished product.
2. A letter and specification sheet certifying that the products of this section meet or exceed specified requirements.
3. Certified copies of independent (third-party) laboratory reports on ASTM tests as follows:
    a. Pile Height, Face Width & Total Fabric Weight, ASTM D418 or D5848
    b. Primary & Secondary (and Tertiary if applicable) Backing Weights, ASTM D418 or D5848
    c. ASTM F2765-09 – Standard Test Method for Measuring Total Lead content in Turf Fibers
    d. EN-71 - Toxicology test results for infill materials
4. List of at least 20 existing completed turf installations over the past five years comprised of 65,000 sq. ft. or more, including Owner representative and telephone number. List must include 5 projects

at least 4 years old.

5. Lists providing specific contacts and telephone numbers of the following:
    a. A football field of 65,000 sq. ft or more of the exact specified material, including the infill material and fiber.
    b. A list of 10 fields that have been in play utilizing the same: exact fiber (length, denure, cross section, stich gage, stich rate, fibers per bundle, etc) that is being proposed for this field.
    c. A sand/SBR rubber infill field in play for at least 5 years.
6. The Turf Contractor and the turf Manufacturer (if different from the company) shall provide a sample copy of insured, non-prorated warranty and pre-paid, non-cancelable warranty insurance policy to be issued by an A- rated carrier and issued in the name of Prince Georges County Public Schools.

C. Submittals prior to ordering of materials:
1. The Contractor shall submit Shop Drawings indicating:
    a. Field Layout with tufted/inlaid lines
    b. Field Marking Plan and details for the specified sports; i.e., VHSL and NFHS.
    c. Roll/Seaming Layout indicating all turf panels by number and how they are to be seamed, by type seam and location, in the field.
    d. Sewing/Adhesives technical specification Sieve Analysis of Sand and Rubber In-Fill
    e. Sample of Cryogenic Rubber and Sand from actual source supplier
    f. Methods of attachment, field openings and perimeter conditions.
    g. Methods of attaching removable/replaceable batters boxes.
    h. Provide a 12” x 12” sample of Resilient Underlayment (if needed).
2. The Turf Manufacturer must submit the fiber manufacturer's name, type of fiber and composition of fiber and all ASTM testing data for each material.
3. Product Data including the following
    a. Submit manufacturer's catalog cuts, material safety data sheets (MSDS), brochures, specifications; preparation and installation instructions and recommendations; storage, handling requirements and recommendations.
    b. Submit data in sufficient detail to indicate compliance with the contract documents.
    c. Submit manufacturer's instructions for installation.
    d. Submit manufacturer's instructions for maintenance for the proper care and preventative maintenance of the synthetic turf system, including painting and markings.

D. Prior to Final Project Acceptance, the Contractor shall submit to the Owner:
1. Three (3) copies of Maintenance Manuals, which will include all necessary instructions for the proper care and preventative maintenance of the synthetic turf system, including painting and markings.
2. Project Record Documents: Record actual locations of seams, drains or other pertinent information.
3. Warranty: Submit Manufacturer Warranty and ensure that forms have been completed in Owner's name and registered with Manufacturer.
4. Provide attic stock requirements, maintenance equipment with training and manuals.

5. Submit written statement signed jointly by General Contractor and synthetic field surfacing supplier/installer stating that the Drawings and Specifications have been reviewed by qualified representatives of the material manufacturer, and that they are in agreement that the materials and system, including drainage, to be used for synthetic field surfacing are proper and adequate for the applications shown.
6. The synthetic turf supplier/installer shall submit at the pre-construction conference a certificate stating that it is not aware of any aspects of the proposed turf system to be installed which knowingly violate any patented materials or methods and that the manufacturer fully indemnifies the Owner and Engineer from any liability arising out of any issue related to patent infringement.
7. Submit a certified statement issued by the synthetic field surfacing materials supplier/installer, attesting that all areas and surfaces designated to receive synthetic field surfacing have been inspected and found satisfactory for the reception of the Work covered under this Section; and are not in conflict with the “Guarantee” requirements. Installation of synthetic field surfacing materials may not commence until final acceptance of finished crushed stone/aggregate base has been received by the Engineer.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section. The Turf Contractor and/or the turf Manufacturer:
   1. Must be experienced in the manufacture and installation of this specific type of synthetic infill grass system for at least 5 years.
   2. Must have 10 fields in play utilizing the same fiber and fiber manufacturer that is being proposed for this field.
   3. Must have installed a minimum of 10 fields of 65,000 sq. ft or more in the past two years with the same manufacturer, product and company, including the exact same infill system, fiber and fiber manufacturer that is being proposed for this field.

B. Installer Qualifications: Company specializing in performing the work of this section.
   1. The Turf Contractor must provide competent workmen skilled in this specific type of synthetic turf installation.
   2. The designated Supervisory Personnel on the project must be certified, in writing by the Turf Manufacturer, as competent in the installation of this material, including sewing seams and proper installation of the infill mixture.
   3. The Synthetic Turf System shall be installed by an experienced Contractor who shall provide a list of at least five completed field installations within the last three years, providing specific information about the name of the product, contact names, addresses, telephone numbers, year of the installation and type of infill material for type of fields.
   4. The installer shall have a manufacturer’s representative on site to certify the installation and Warranty compliance.

C. Prior to the beginning of installation, the Installer of the synthetic turf shall inspect the existing aggregate base condition and palanarity. The installer will accept the surface in writing when the contractor verifies test results for planarity and permeability that are in compliance with the synthetic turf manufacturer’s specifications. The Installer shall have the dimensions of the field and locations for markings measured by a registered surveyor (in the State of Maryland) to verify conformity to the specifications and applicable standards.

D. The Turf Contractor shall provide the necessary testing data to the owner that the finished field meets the required shock attenuation, as per ASTM F1936. The synthetic field surfacing materials supplier/installer shall provide (arrange and pay for) G-Max testing on the installed surface prior to acceptance and it shall be repeated at one year intervals throughout the turf manufacturer's guarantee period at no additional cost. Testing shall be preformed in accordance with ASTM F-355-Method A, by an independent materials testing laboratory cerified to preform this test and subject to the approval of the Engineer. "In-house" laboratories with a busines affiliation to the turf manufacturer and/or installer are unacceptable. Over the life of the warranty, changes in the average G-Max that exceed +20% of the original installed system shall be remedied by the synthetic field surfacing supplier/installer within 30 days of the deficient test results.

1.05 TESTING AND INSPECTION

A. ASTM Standard Test Methods shall apply to turf products submitted. All test methods shall be accurately referenced and verified by a third party agency:

1. D1577 - Standard Test Method for Linear Density of Textile Fiber
2. D5848- Standard Test Method for Testing Pile Yarn Floor Covering Construction D1338 - Standard Test Method for Tuft Bind of Pile Yarn Floor Coverings
3. D1682 - Standard Method of Test for Breaking Load and Elongation of Textile Fabrics
4. D5034 - Standard Test Method of Breaking Strength and Elongation of Textile Fabrics (Grab Test)
5. F1015- Standard Test Method for Relative Abrasiveness of Synthetic Turf Playing Surfaces F2765-09 – Standard Test Method for Measuring Total Lead content in Turf Fibers
6. D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity
7. D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials
8. F355- Standard Test Method for Shock-Absorbing Properties of Playing Surfaces. F1936
9. F1936- Standard Test Method for Shock-Absorbing Properties of North American Football Field Playing Systems as Measured in the Field

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. The Synthetic Turf products indentified for the purpose of this project are:

1. Astroturf – Stadium Field - 2.5" XPE (Slit Film min 45oz/SY)
2. Shaw Sports Turf – Stadium Field - 2.5" Momentum (Slit Film min 45oz/SY)
3. Field Turf – Stadium Field - 2.5" Classic HD (Slit Film min 45oz/SY)

B. Selection of these products represents the required minimum performance criteria as outlined herein. The manufacturer's performance criteria and product properties and declarations both physical and chemical are as represented by the manufacturers at the time of this solicitation. Requests for pre-approval of products must be submitted to the owner and approved prior to pre-bid meeting and bid receipt.

2.02 MATERIALS

A. The component materials of the synthetic turf system consist of:

1. A Carpet made of slit film polyethylene fibers tufted into a fibrous, perforated or porous backing.

2. An Infill that is a controlled mixture of graded silica sand and rubber crumb that partially covers the carpet to the specified depth of 47mm +/- 1mm.
3. Crumb Rubber infill color is preferred to be black.
4. Glue, thread, paint, seaming fabric and other materials used to install and mark the synthetic turf.

B. The installed synthetic turf shall have the following properties:

Standard	Property	Specification
---- Fiber type	Slit Film	Slit Film Polyethylene
		Min 130 micron thickness
ASTM D1577	Fiber Denier	9500 nominal
ASTM D418/D5848	Pile Height	2 1/2” nominal
	Infill Depth	1 7/8" - 47mm (+/-1mm)
ASTM D418/D5848	Pile Weight	Minimum 45 oz./sq. yd.
ASTM D1335	Tuft Bind	min 8 lbs. (with infill)
ASTM D1682/D5034	Grab Tear (width)	200 lbs/force
ASTM D1682/D5034	Grab Tear (length)	200 lbs/force
ASTM F1015	Relative Abrasiveness Index	<25
ASTM D4491	Carpet Permeability	>14 inches/hour
ASTM F355/F1936	Impact Attenuation, Gmax	(<120) at installation
		=<165 over field warranty life

C. The Carpet shall consist of fibers tufted into a primary backing with a secondary backing, consisting of a minimum of two layers

1. The Carpet shall be furnished in 15’ wide rolls. Rolls shall be long enough to go from sideline to sideline without splicing. The perimeter white line shall be tufted into the individual sideline rolls. Head seams, other than at sidelines, will not be acceptable
2. The Carpet’s primary backing shall be a minimum double-layered polypropylene fabric treated with UV inhibitors. The secondary coating shall consist of an application of porous, heat-activated urethane to permanently lock the fiber tufts in place. Perforated (i.e. with punched or burned holes) backed carpet shall be acceptable however will need to be reviewed and approved by the owner/engineer on a case by case basis.
3. The fiber shall be 9,500 denier, low friction, UV-resistant fiber measuring not less than 2 ½ inches high. The same fiber from the above listed projects (Section 1.04, art. C. 5) must be used on this project. Systems with less than a 2 ½ - inch fiber will not be accepted as equivalent.

D. The Infill materials shall be approved by the Manufacturer. The Infill shall consist of a resilient granular system, comprising selected and graded, rounded, washed/dust-free silica sand and SBR cryogenic rubber crumb. The silica sand component of the infill must be represented by a minimum of 40% of the total infill, by weight. Silica sand within the infill mix, min 35% by weight, will meet the following size distribution and Gmax requirements:

U.S. (Mesh)	Metric (mm)	% Retained per sieve
16	1.190	0
20	08.840	0-3
25	0.710	10-30
30	0.590	30-50
35	0.500	15-35
40	0.420	5-15

50	0.297	<5
70	0.210	Trace

a. Silica Sand will consist of uniform, sub-angular to rounded, single grains.It will be dust-free, and unground. Crusher fines are unacceptable.

E. Rubber crumb within the infill mix will meet the following size distribution and have a specific gravity of no less than 1.1%:

U.S. (Mesh)	Metric (mm)	% Passing	% Retained
12	1.680	100	0
14	1.410	96-100	0-5
16	1.190	82-100	0-15
20	0.840	30-66	30-80
30	0.590	0-24	20-50
40	0.420	0-4	5-20
50	0.297	0	0-5
60	0.250		0

F. Non-tufted or inlaid lines and markings shall be painted with paint approved by the synthetic turf Manufacturer.

G. Thread for sewing seams of turf shall be as recommended by the synthetic turf Manufacturer.

H. Glue and seaming fabric for inlaying lines and markings shall be as recommended by the synthetic turf Manufacturer. All turf roll seams must be sewn.

I. Restoration of Damage: The Infilled Synthetic Turf Installation contractor shall exercise care in the execution of his work and avoid damage or defacement of the aggregate base system or surrounding areas by using suitable equipment or protective means. Damage or defacement that occurs shall be remedied at either the Base Contractor’s and/or the Infilled Synthetic Turf Vendor’s cost to the satisfaction of the Owner.

2.03 WARRANTIES

A. The synthetic turf must maintain an ASTM 355 G-max below 165 for the life of the Warranty. The initial installation must have a Gmax of (<120) upon completion, per ASTM F1936.

B. Sample Warranty: Must be provided with bid submittal. Provide a sample pre paid third party insured warranty with the bid. Policy must be valid and in force at time of bid.

C. Warranties: The Contractor shall provide a warranty to the Owner that covers defects in materials and workmanship of the turf for a period of eight (8) years from the date of substantial completion. The turf manufacturer must verify that their representative has inspected the installation and that the work conforms to the manufacturer's requirements. The manufacturer's warranty shall also include general wear and damage caused from UV degradation.

D. The warranty shall be fully third party insured, pre paid for the entire 8 year term and be non-prorated. The Contractor shall provide a warranty to the Owner that covers defects in the installation workmanship, and further warrant that the installation was done in accordance with both the manufacturer's recommendations and any written directives of the manufacturer's representative. Prior to final payment for the synthetic turf, the Contractor shall submit to owner an insurance policy, guaranteeing the warranty to the Owner.

E. The synthetic turf suppliers/installers shall provide a written guarantee stating that all work executed under this section will be free from defects of material and workmanship for a period of eight (8) years from date of Substantial Completion, and that any defects will be remedied on written notice at no

additional cost to the Owner. The warranty shall be in writing and shall be signed by the Installer and synthetic field surfacing materials manufacturer. Guarantee shall include removal and replacement of materials as required, to repair synthetic field surfacing at no cost to the Owner. This warranty shall not be pro-rated, rather it shall provide for the full replacement value of defective aspects of the installation throughout the life of the warranty.

F. In addition to the manufacturer's/installer's warranty described above, the synthetic turf manufacturer will provide the Owner with a third party insurance policy acceptable to the Owner, pre-paid for a full eight (8) years and not cancelable, issued in the name of the Owner, by a US insurance company rated AM Best A- or better, which provides the same warranty coverage established above, in the event that the turf manufacturer is unable or unwilling to provide the specified coverage. A copy of the policy will be required prior to award of the contract and an executed policy in the Owner's name will be required prior to final payment.

G. Shock Absorbency (to ASTM F 355): Immediately upon substantial completion, the Contractor shall arrange for shock absorbency testing by a certified laboratory subject to approval by the Engineer in accordance with ASTM F 335 Method A. Testing will be performed at a minimum of ten locations selected by the Engineer. The average G-Max value at installation shall be under 120. The Contractor, prior to acceptance, shall remedy an average G-Max value outside this range, or individual reading more than 15% outside this range. Satisfactory G-Max testing shall be a fixed requirement for final payment of the synthetic turf installation and release of retainage.

H. Over the life of the guarantee, the turf supplier/installer shall arrange and pay for annual re-testing of the field using the same procedure, within 30 days (±) of the anniversary of the original test date upon request by the Owner. The turf supplier/installer shall take whatever action is required to remedy any average G- Max value greater than 20% of the average value at installation, and to remedy any areas with individual readings over 165. These costs will be included in the turf price proposal.

I. The insurance policy must reflect the following values:

1. No maximum per claim coverage amount.
2. Minimum of five - million dollar annual aggregate
3. Must cover full 100% replacement value of total square footage installed, minimum of $5.50 per sqft.
4. Pre Paid 8 year third party policy must be issued by a carrier with an A.M. Best rated "A-" or better rating.
5. Policies that include self insurance or self retention clauses shall not be considered.
6. Policy can not include any form of deductible amount. Policy must be valid and in force at time of bid.

PART 3 – EXECUTION

3.01 GENERAL

A. The installation shall be performed in full compliance with Manufacturers recommendations and contract drawings.

B. Only trained technicians, skilled in the installation of athletic caliber synthetic turf systems working under the direct supervision of the approved installer supervisors, shall undertake any cutting, sewing, gluing, shearing, and topdressing or brushing operations.

C. The designated Supervisory personnel on the project must be certified, in writing by the turf Manufacturer, as competent in the installation of this material, including sewing seams and proper installation of the Infill mixture.

D. All designs, markings, layouts, and materials shall conform to all currently applicable National Federation of State High School Association rules and other standards that may apply to this type of synthetic grass installation.

3.02 PRE-INSTALLATION MEETING

A. Convene one week before starting work of this section with contractors involved, turf manufacturer representative, Installation Superintendent, Owner and Engineer.

B. Pre-installation meeting is required between general contractor, turf installation company, and base contractor prior to installing the synthetic turf system. The subsurface conditions must be accepted in writing by General Contractor, Turf Manufacturer and/or Turf Installation Company.

3.03 DELIVERY, STORAGE, AND PROTECTION

A. Deliver products to project site in wrapped condition.

B. Provide a copy of delivery receipt to owner indicating quantity of materials delivered. Provide all turf roll Identification decals to the owner to verify origin and material details.

C. Store weather sensitive products under cover and elevated above grade.

3.04 MAINTENANCE EQUIPMENT AND TRAINING

A. The turf manufacturer shall furnish and train the owner on a approved 7ft mechanical sweeper unit manufactured by Sportsfield Specialties Inc. or Greens Groomer to be used for debris removal and surface contaminants.

B. The turf manufacturer shall furnish and train the owner with field grooming equipment supplied by Sports Field Specialties 15’ folding Fieldspec Drag Brush and shall be approved for use on the selected manufacturers turf.

C. Turf manufacturer shall establish maintenance schedule and method of documenting owner maintenance as part of the O&M documents.

3.05 EXAMINATION

A. The surface to receive the synthetic turf shall be inspected by the Installer, and prior to the beginning of installation, the Installer must accept the sub-surface in writing. The acceptance will depend on the General Contractor providing the owner with test results indicating that compaction, planarity and permeability are in compliance with the synthetic turf manufacturer’s specifications. The surface must be perfectly clean as installation commences and shall be maintained in that condition throughout the process.

B. The compaction of the aggregate base shall be 90% in any newly constructed areas or excavated areas, according to the standard proctor procedure (ASTM D 698), and the surface tolerance shall not exceed 0- 3/16 inch over 10 feet and 0-½" from design grade. Contractor shall furnish evidence of same for the field prior to commencement of the turf installation via as-built topography in a 25ft grid (from a licensed land surveyor) and also via documented planarity tests performed on entire field witnessed by the engineer.

C. Notify the General Contractor and Owner in writing of any unsatisfactory conditions. Do not begin turf installation until these conditions have been satisfactorily corrected.

3.06 INSTALLATION

A. Install in accordance with Manufacturer's instructions. The Turf Contractor shall strictly adhere to the installation procedures outlined under this section. Any variance from these requirements must be accepted in writing, by the Manufacturer’s onsite representative, and submitted to the Engineer/Owner, verifying that the changes do not in any way affect the warranty. Infill materials shall be approved by the

Manufacturer and installed in accordance with the Manufacturer's standard procedures.

B. The carpet rolls are to be installed directly over the accepted aggregate base surface. Extreme care should be taken to avoid disturbing the underlayment material and aggregate base, both in regard to compaction and planarity.

C. The full width rolls shall be laid out across the field. Turf shall be of sufficient length to permit full cross-field installation from sideline to sideline. No head or cross seams will be allowed in the main playing area between the sidelines. Utilizing standard state of the art sewing procedures, each roll shall be sewn properly to the next. When all of the rolls of the playing surface have been installed, the sideline areas shall be installed at right angles to the playing field turf. These rolls shall be sewn as well.

D. This is a 99% sewn installation. Gluing of rolls shall not be acceptable. Minimum gluing will only be permitted to repair problem areas, corner completions, and to install in any logos or inlaid lines as required by the specifications. All seams shall be sewn using double bagger stitches and polyester thread or adhered using seaming tape and high grade adhesive (per the manufacturer's standard procedures). Seams shall be flat, tight, and permanent with no separation or fraying.

E. Infill materials shall be applied in numerous thin lifts. The turf shall be brushed as the mixture is applied.

F. The Infill materials shall be installed to fill the voids between the fibers and allow the fibers to remain vertical and non-directional. The Infill shall be installed to the depth of 1 7/8". The Infill shall be placed so that there is a void of 5/8" to the top of the fibers when initially installed to account for 1/8" settlement.

G. Prior to the application of any line painting the turf shall be fibrillated by means of a nylon rotary brush to provide the look, feel, and safety of optimally maintained natural grass, including subtle undulations normally associated with natural grass athletic fields.

H. Non-tufted or inlaid lines and markings shall be painted according to the recommendations of the turf Manufacturer and of the paint manufacturer. Several applications may be required.

I. Provide extra turf and infill for replacement of the complete cirlular LAX goal creases (2) once during the warranty period. Include turf replacement cost for the 2 circular goals in bid cost. Owner is not responsible for replacement labor costs or material costs for the one set of replacement LAX goals.

J. Synthetic turf shall be attached to the perimeter edge detail in accordance with the Manufacturer's standard procedures.

K. Installation shall not proceed when:

1. Ambient air temperature is below forty (40) degrees Fahrenheit (F).
2. Material temperature is below forty (40) degrees Fahrenheit (F).
3. Rain is falling or pending, unless acceptable to qualified installers.
4. Conditions exist, or are pending, that will be unsuitable for the installation of the system.

L. Follow-up Visits

1. The turf manufacturer/installer shall include in their price, two (2) follow-up visits at six month intervals after the final turf inspection date. The visits shall be scheduled by the Owner or Engineer to inspect the condition of the synthetic turf, infill material, seams, painted lines, anchorage, and peripheral attachments. Items found to require repair, amendment, or replacement shall be the responsibility of the turf manufacturer/installer. Repairs, except those required due to vandalism, shall take place immediately upon notification by the Engineer.
2. The manufacturer shall include the cost to perform independant Gmax testing once per year for 8 years after turf is installed. Manufacturer shall arrange Gmax testing yearly and supply owner with test results identifiing any deficiencies or issues observed during the test and field inspection. Any

maintenance issues shall be identified and proper instructions to the owner for corrective action. Any Gmax value outside of the allowed tolerances shall be identifed and corrected by the turf manufacturer.

3. Scope to include replacing turf system at 2 LAX goal circular areas once during warranty period.
    a. one set of replacement circular LAX goals to be provided to owner as part of attic stock for replacement at owners descression. Infill shall also be included as part of attic stock for replacement of LAX goals.

3.07 FIELD MARKINGS

A. The stadium field will have the following lines tufted or inlaid according to NFSHSA standards:
    1. Football: tufted markings (WHITE). Color shall be white, except where noted.
        a. Side lines and End lines
        b. 5-yd lines
        c. Goal lines
        d. Player's box
        e. Coach's box
    2. Soccer (Yellow): Inlayed and Tufted markings.
        a. Side lines
        b. End lines
    3. Boys LAX (Blue): Inlayed and Tufted markings
        a. All boys LAX lines
    4. Womens LAX (Orange): Inlayed and Tufted markings
        a. All womens LAX lines
    5. Womens Field Hockey (Red): 4 inch Tick marks only
B. The stadium field will have the following markings inlaid and as shown on the drawings:
    1. Football: Color shall be white, except where noted.
        a. 10 yard numbers and arrows in white with black shadows outline
        b. 1-yd hash markings (two sets)
        c. Inbound hash markings
        d. Extra point lines
        e. Kick off markings
        f. Limit lines
        g. Coaches Boxes
    2. Soccer:
        a. Full lines: Center Circle, corner kicks, penalty kicks and all arcs
    3. Mens and Womens LAX: Color shall be blue for mens, orange for womens
        a. Full Lines
    4. Womens Field Hockey: Tick marks Color shall be red

a. Tick Marks – 4” inch square

C. The center field logo will be inlaid according to the school mascot artwork submitted by the Owner or Engineer to the turf Manufacturer or Turf Contractor, subject to the availability of colors. The logo shall fit within a 50 foot diameter circle at the center of the field.

D. The end-zones will be color (not green, to be chosen by owner) with 4” color outlined end zone letters (stadium field only) and will be inlaid to include the school mascot name in one endzone and the school name in the opposite endzone (placement to be chosen by owner) according to artwork and fonts submitted by the Owner or Engineer to the turf Manufacturer or Turf Contractor, subject to the availability of colors.

E. Standards

1. Standards; all lines and markings shall be to National Federation of State High School Association Standards.

2. Refer to drawing details for linework and striping details. Center field logo image file to be provided by Engineer /Owner during submittal process.

3.08 SURPLUS MATERIALS

A. The Contractor shall provide the Owner, at each installation as a part of the Contract, the following surplus materials transported to storage location selected by the Owner:

1. Synthetic Turf Fabric (green) – 500 square feet

2. Synthetic Turf Fabric (White, Yellow, Blue, Orange and Red) – 50 linear feet each

3. Infill Material – minimum 2 supersacs as required to infill 500 square feet. This material shall not be used by the Synthetic Turf Subcontractor to maintain depth and Gmax values during the warranty period. The Contractor must provide material, matching the existing infill material if needed for maintenance , during the warranty period at no cost to the Owner.

3.09 CLEANING AND PROTECTION

A. Do not permit traffic over unprotected Synthetic Turf surface or Track surface.

B. Contractor shall provide the labor, supplies, and equipment as necessary for final cleaning of surfaces and installed items.

C. All usable remnants of new material shall be come the property of the Owner. These shall become the contractors responsibility to dispose if not wanted by owner.

D. The Contractor shall keep the area clean throughout the project and clear of debris.

E. Surfaces, recesses, enclosures, etc., shall be cleaned as necessary to leave the work area in a clean, immaculate condition ready for immediate occupancy and use by the Owner.

END OF SECTION

SECTION 32 3300
SITE FURNISHINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Benches.

B. Bollards.

C. Planters.

D. Tables.

E. Waste receptacles.

F. Skate deterrents.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Bollard infill and underground encasement.

B. Section 04 7200 - Cast Stone Masonry: Architectural cast stone benches and bollards.

C. Section 05 5000 - Metal Fabrications: Anchors to attach site furnishings to mounting surfaces.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.

C. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2013.

D. ASTM A536 - Standard Specification for Ductile Iron Castings 1984 (Reapproved 2014).

E. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

F. ASTM B26/B26M - Standard Specification for Aluminum-Alloy Sand Castings 2018.

G. ASTM B211 - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire 2012.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's specifications and descriptive literature, installation instructions, and maintenance information.

C. Shop Drawings: Indicate plans for each unit or groups of units, elevations with model number, overall dimensions; construction, and anchorage details.

D. Samples: Submit two sets of manufacturer's available colors for metal furnishings.

1.05 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide manufacturer’s warranty against defects in materials or workmanship for ductile iron castings for a period of 10 years from Date of Substantial Completion.

C. Provide manufacturer’s Lifetime Warranty against defects in materials or workmanship for wood benches manufactured from solid teak.

1.06 QUALITY ASSURANCE

A. Layout Review: Contractor shall stake layout of all site furnishings and signage, and request a review by Owner's Representative with notice of 5 working days prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Furnishings:
   1. BRP by Bison, Inc: www.brpbybison.com/#sle.
   2. Neenah Foundry, a division of Neenah Enterprises, Inc: www.nfco.com/#sle.
   3. Tectura Designs, a division of Wausau Tile Inc: www.tecturadesigns.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Precast Furnishings:

C. Steel Pipe Bollards:
   1. FairWeather Site Furnishings: www.fairweathersf.com/#sle.
   2. Huntco Supply, LLC: www.huntco.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.

D. Wood Benches:
   1. Anderson Teak, LLC: www.andersonteak.com/#sle.
   2. Bench Smith, LLC: www.benchsmith.com/#sle.
   3. Westminster Teak, Inc: www.westminsterteak.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

E. Skate Deterrents:
   1. The Park Catalog: www.theparkcatalog.com/#sle.
   2. Skate Stoppers: www.skatestoppers.com/#sle.
   3. StopAGrind: www.stopagrind.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 METAL FURNISHINGS

A. Metal Furnishings, General:
   1. Cast iron components: Ductile iron castings complying with ASTM A536; cleaned, treated, and powder-coated.
      a. Color: As selected by Architect from manufacturer's standard range.
   2. Steel components: Plates, bars, and shapes complying with ASTM A36/A36M and tubing complying with ASTM A500/A500M; cleaned, treated, and powder-coated.
      a. Color: As selected by Architect from manufacturer's standard range.
   3. Wood components: Western red cedar with eased edges, and clear wood preservative coating.
   4. Hardware: Stainless steel.

B. Benches: Metal frame and seat section with back.
   1. Frame: Steel.

2. Seat: Wood slat.
3. Intermediate support: Locate at midpoint.
4. Intermediate arm rest. Locate at midpoint.
5. Mounting: Surface.

C. Planters: Steel frame with steel slats.
1. Shape: Square.
2. Wall liners: Galvanized steel panels welded inside planter frame as integral part of planter unit.
3. Inserts: Plastic containers for potting soil.
4. Mounting: Surface.

D. Waste Receptacles: Steel frame with steel slats and removable lid.
1. Capacity: 20 gallons (76 liters).
2. Shape: Round.
3. Diameter: TBD.
4. Wall liners: Galvanized steel panels welded inside waste receptacle frame as integral part of waste receptacle unit.
5. Inserts: Removable plastic containers for waste material.

2.03 PRECAST CONCRETE FURNISHINGS

A. Precast Concrete Furnishings, General:
1. Precast Concrete Components: Mixture of cement, aggregates, water, and mineral colors; molded to shape, and reinforced with steel bars.
a. Finish:
1) Horizontal Surfaces: Smooth for seats and table tops.
2) Vertical Surfaces: Smooth for supports and sides.
b. Color: As selected by Architect from manufacturer's standard range.
c. Color: As indicated on drawings.
d. Clear Sealers: Anti-graffiti.
2. Hardware: Stainless steel.

B. Benches: Frame and seat section with back.
1. Frame: Precast concrete.
2. Seat: Precast concrete.

C. Planters: Precast concrete with drain holes.
1. Shape: Round.
2. Diameter: TBD By Owner.

2.04 WOOD BENCHES

A. Materials:
1. Wood: Solid, A -Grade Teak.
2. Factory Finish: Natural.

B. Benches: Solid wood supports and seat section with back.
   1. Shape: Rectangle.

2.05 BOLLARDS

A. Steel Pipe Bollards: Hollow steel pipe with plain shaft.
   1. Materials:
      a. Steel Pipe: ASTM A53/A53M, standard weight.
      b. Factory Finish: Primed.
      c. Color: As selected by Architect from manufacturer's standard range.
   2. Mounting: In-ground.

B. Precast Concrete Bollards:
   1. Shape: Round.

2.06 SKATE DETERRENTS

A. Skate Deterrents:
   1. Material: Aluminum; ASTM B26/B26M, 319 alloy; clear anodized finish.
   2. Attachment: Surface mounted to benches, planters, tables and table seating.
   3. Anchoring: Tamper-resistant screws, pins or bolts as recommended by manufacturer.
   4. Shape: Fixed radius curve.
   5. Spacing: As indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that mounting surfaces, preinstalled anchor bolts, or other mounting devices are properly installed; and ready to receive site furnishing items.

B. See Section 05 5000 for anchors to attach site furnishings to mounting surfaces.

C. Do not begin installation until unacceptable conditions are corrected.

3.02 INSTALLATION

A. Install site furnishings in accordance with approved shop drawings, and manufacturer's installation instructions.

B. See Section 03 3000 for bollard infill and underground encasement.

C. Provide level mounting surfaces for site furnishing items.

END OF SECTION

SECTION 32 3313
SITE BICYCLE RACKS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior bicycle racks.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Mounting surface for bicycle racks.

B. Section 05 5000 - Metal Fabrications: Custom metal outdoor furnishings.

C. Section 32 1313 - Concrete Paving: Mounting surface for bicycle racks.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.

B. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service 2015a.

C. ASTM A312/A312M - Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes 2018a.

D. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2013.

E. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2018, with Editorial Revision (2018).

F. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2016, with Editorial Revision (2016).

G. ASTM C150/C150M - Standard Specification for Portland Cement 2018.

H. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete 2010a (Reapproved 2016).

I. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete 2017a.

J. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements 2016.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings: Indicate size, shape, and dimensions, including clearances from adjacent walls, doors, and obstructions.

D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

1.05 QUALIITY ASSURANCE

A. Manufacturer Qualifications:

1. A company experienced in manufacturing bicycle racks similar to those required for this project and with a record of successful in-service performance.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Installer Qualifications:

1. An experienced installer who has completed installation of bicycle racks similar in material, design, and extent to that indicated for this project and whose work has resulted in construction with a record of successful in-service performance.

B. Source Limitations: Obtain each color, finish, shape and type of bicycle rack from a single source with resources to provide components of consistent quality in appearance and physical properties.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Install in areas designated by Architect.
2. Do not proceed with remaining work until workmanship and installation are approved by Architect.
3. Refinish mock-up area as required to produce acceptable work.

D. Store products in manufacturer's unopened packaging until ready for installation.

E. Handle racks with sufficient care to prevent scratches and other damage to the finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Exterior Bicycle Racks:

1. American Bicycle Security Company: www.ameribike.com/#sle.
2. Columbia Cascade Company: www.timberform.com/#sle.
3. Huntco Supply, LLC: www.huntco.com/#sle.
4. Neenah Foundry, a division of Neenah Enterprises, Inc: www.nfco.com/#sle.
5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 BICYCLE RACKS

A. Exterior Bicycle Racks: Device allows user-provided lock to simultaneously secure one wheel and part of the frame on each bicycle parked or racked.

1. Capacity: Seven bicycles.
2. Mounting, Ground: In-ground anchor.
3. Mounting, Wall: Post-installed anchor.
4. Finish: Powder coat, maintenance-free and weather-resistant.
5. Color: As indicated on drawings..
6. Accessories: Surface flange cover.

B. Materials:

1. Pipe: Carbon steel, ASTM A53/A53M, Schedule 40.
2. Tube: Carbon steel, ASTM A500/A500M.
3. Bar, Round and Flat, Carbon Steel: ASTM A36/A36M.
4. Precast Concrete:
    a. Cement: ASTM C150/C150M, Portland Type I - Normal; white color.

b. Concrete Materials: ASTM C33/C33M aggregate, water, and sand.

c. Reinforcing Steel: ASTM A615/A615M, deformed steel bars; unfinished, strength and size required by precast unit design.

d. Concrete Mix: Minimum 5000 psi (34 MPa), 28 day strength, air entrained to 5 to 7 percent.

e. Air Entrainment Admixture: ASTM C260/C260M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive bicycle racks.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory conditions before proceeding.

C. Do not begin installation until unsatisfactory conditions are corrected.

3.02 PREPARATION

A. Ensure surfaces to receive bicycle racks are clean, flat, and level.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install level, plumb, square, and correctly located as indicated on drawings.

C. In-Ground Anchor Installation:

1. Prepare holes in size according to manufacturer’s instructions.
2. Place anchoring bolts through the holes in pipe.
3. Lower rack into holes, ensuring the bottom of lower bends are at least 1-1/2 inch (38 mm) from the ground.
4. Place concrete.
5. Level rack before concrete sets.
6. Support until dry.

D. Post-Installed Anchors: Comply with ICC-ES AC308.

3.04 CLEANING

A. Clean installed work to like-new condition. Do not use cleaning materials or methods that could damage finish.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 32 3314
SITE BICYCLE LOCKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior bicycle lockers.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Mounting surface for bicycle lockers.

B. Section 05 5000 - Metal Fabrications: Custom metal outdoor furnishings.

C. Section 32 1313 - Concrete Paving: Mounting surface for bicycle lockers.

1.03 PRICE AND PAYMENT PROCEDURES

A. See Section 01 2300 - Alternates, for product alternatives affecting this section.

1.04 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2017.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

D. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements 2016.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings: Indicate size, shape, and dimensions, including clearances from adjacent walls, doors, and obstructions.

D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

1.06 QUALITY ASSURANCE

A. Products: Manufactured to ISO 9000 or ISO 14000 requirements.

B. Manufacturer Qualifications A company specialized in the manufacture of fiberglass reinforced plastic/SMC composite.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Conformance: Conform to Class I Bicycle Parking Facilities requirements.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Handle lockers with sufficient care to prevent scratches and other damage to the finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Exterior Bicycle Lockers:

1. American Bicycle Security Company: www.ameribike.com/#sle.
2. Columbia Cascade Company: www.timberform.com/#sle.
3. CycleSafe, Inc: www.cyclesafe.com/#sle.
4. Huntco Supply, LLC: www.huntco.com/#sle.
5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 BICYCLE LOCKERS

A. Exterior Steel Bicycle Lockers: Secure storage enclosure fabricated of steel panels with factory applied finish and factory installed hardware.

1. Capacity: One bicycle per unit.
2. Layout: Horizontal.
3. Panels: Steel sheet, 12 gage, 0.1046 inch (2.66 mm) minimum thickness, with manufacturer's standard perforations.
4. Door and Frame: Steel sheet; 12 gage, 0.1046 inch (2.66 mm) minimum thickness, door factory hung and adjusted.
5. Hardware:
    a. Door Hinges: Full length, piano type hinges of 14 gage, 0.0781 inch (1.98 mm) minimum thickness, stainless steel.
    b. Locking Mechanism: Steel vertical locking bar running full length of door.
    c. Lock Hardware: Manufacturer's standard stainless steel pistol grip style handle with "U" style lock and padlock adapter.
6. Mounting, Ground: Leveling and anchoring system consisting of feet adjustable up to 5 inches (127 mm) vertically and flanges suitable for bolts or post-installed anchors..
7. Mounting, Wall: Post-installed anchor.
8. Finish: Powder coat, factory applied over primer.
9. Color: As indicated on drawings.

B. Materials:

1. Bar, Round and Flat, Carbon Steel: ASTM A36/A36M.
2. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating.
3. Bar Round and Flat, Stainless Steel: ASTM A666, Type 304.
4. Stainless Steel Sheet: ASTM A666 Type 304, soft temper.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive bicycle lockers.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Do not begin installation until unsatisfactory substrates have been properly repaired.

3.02 PREPARATION

A. Ensure surfaces to receive bicycle lockers are clean, flat, and level.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install bicycle lockers level, plumb, square, and correctly located as indicated on drawings.

C. Post-Installed Anchors: Comply with ICC-ES AC308.

D. Surface Flange Installation: Anchor bicycle lockers securely in place with 1/2 inch (13 mm) by 4 inch (101 mm) anchor bolts through flange holes.

3.04 CLEANING

A. Clean installed work to like-new condition. Do not use cleaning materials or methods that could damage finish.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 32 9000
TREE CONSERVATION

PART 1 - GENERAL:

1.01 DESCRIPTION:

A. This section specifies labor, materials, and equipment and services necessary for and reasonably incidental to preservation, protection and care of trees as shown on the Drawings, specified or directed.

1.02 QUALITY ASSURANCE:

A. Methods for tree preservation and protection shall conform to details shown on the Drawings and any pertinent nationally recognized standards.

B. The Contractor shall during pre-construction activities, construction activities and post- construction activities employ an ISA (International Society of Arboriculture) certified arborist with a minimum of two years experience in tree preservation. The Contractor shall submit documentation that arborist has the above qualifications.

C. The arborist shall be on-site at any time work is being performed in the vicinity of trees to supervise implementation of procedures for tree protection, to monitor tree health during construction operations and the installation of pipes, curbs, sidewalks, etc and to supervise any repair of damages after construction.

D. All work must be contained within the prescribed limits of disturbance shown on the contract documents.

1.03 SUBMITTALS:

A. Provide written report by a certified arborist identifying root evaluations of the trees, which are in potential conflict with construction to determine the critical root zones.

B. Provide written report by a certified arborist indicating the best methods of construction, which will minimize the impact on the critical root zone. Obtain specifications from the arborist for individual tree protection and maintenance as required for the identified to be saved on the Drawings.

PART 2 - PRODUCTS:

2.01 TREE PROTECTION DEVICE:

A. Fencing shall be tenax alpi or approved equal. It shall be blaze orange plastic mesh at least forty-eight (48) inches in height, with grid openings not greater than three (3) inches in width.

2.02 SOIL AMENDMENTS:

A. Suitable organic matter shall be peat moss, composted manure, deactivated sewage sludge or similar material as approved by the arborist or engineer.

B. Special soil mixture is composed of one part suitable organic matter and 6 parts backfill. Backfill material shall be loose, fine, friable, even textured loam. The mixture shall not contain any rock fragments larger than four (4) inches in any direction, nor construction debris of any sort.

PART 3 - EXECUTION:

3.01 PRECONSTRUCTION ACTIVITIES:

A. The limits of disturbance shall be located and flagged by the Contractor in the field prior to any stress reduction or construction activities. Limits of Disturbance shall be placed outside of critical root zones of trees to be preserved wherever possible.

B. As shown on the plans, trees which are to be preserved shall have their roots pruned. Root pruning trenches shall be located within one foot of limits of disturbance. Roots shall be cleanly cut to a depth of at least 24 inches using a vibratory plow (cable laying machine), tooth- chain trencher or other acceptable

equipment. Fill trench as soon as possible with soil mixture herein described and pack to eliminate air pockets.

C. Fertilize trees in construction area at the rate of 3 pounds of nitrogen per 1,000 square feet of root zone disturbed. Apply fertilizer to entire critical root zone out to root pruning trench. Fertilizer should be at least 50 percent (50%) slow release nitrogen and contain other essential elements and micronutrients.

D. Water critical root zone immediately after applying fertilizer to saturate the top 6 inches of soil.

E. Mulch 2-4 inches deep comprised of weed-free straw, woodchips, shredded bark or leaves shall be applied in the critical root zone adjacent to the pruning trench. Mulching shall not extend farther than 20 feet from the pruning trench.

F. Trees which are dead or dying or are in poor condition prior to the start of construction shall be flagged and recorded on the plan.

G. Blaze Orange Plastic Mesh Fence

1. All tree Preservation Areas shall be surrounded by blaze orange plastic mesh fences.
2. Boundaries of fencing shall be staked, flagged and approved prior to installation.
3. All fencing shall be installed prior to construction activities.
4. Fences shall be firmly anchored at a spacing no greater than eight (8) feet and constructed in a manner which precludes sagging.
5. All fencing shall be maintained in a good condition and promptly repaired or restored as the situation warrants.

3.02 CONSTRUCTION PHASE

A. Any on-site decisions regarding conditions or activities which may be injurious to the health of certain specimen trees in the vicinity of the construction area shall be made in consultation with the specified arborist.

B. Excavated and backfill material shall not be placed or side cast within the critical root zones of trees to be preserved.

C. Construction equipment shall not be driven into or through protected trees, nor shall swinging cranes or backhoes be allowed in their canopies.

D. There shall be no stacking or storing supplies within the critical root zones of trees to be preserved.

E. Trees to be removed shall be taken out without damaging protected trees.

F. There shall be no burning in or close to protected trees.

G. Changing site grades which will cause drainage to flow into, or to collect near protected trees shall be prohibited. All grading shall take place outside the critical root zone of the trees to be protected.

H. All equipment shall be kept outside the blaze orange fencing.

I. In the event of drought, the protected trees shall be monitored for signs of stress and watered as needed or as directed by the arborist.

J. The certified arborist shall also monitor trees to be preserved for any other conditions or activities not mentioned above which may be injurious to their health.

3.03 POST-CONSTRUCTION ACTIVITIES

A. Repair & Care of Tree Damages

1. The ends of any additional roots damaged or cut during the construction phase of the project which have not already been pruned and dressed at the outset of the project shall be cut off smoothly.

Then peat moss or other suitable organic matter shall be added to the backfill material at a ratio of 1 part organic matter to 6 parts backfill. Fill and pack around roots to avoid air spaces. Restore grades to preconstruction elevations.

2. Damaged limbs and dead limbs shall be removed if a safety hazard or if injurious to the health of the tree. Tree crown reduction procedures may be employed to promote the health of a tree and shall be performed by a certified arborist.
3. If a tree is wounded during construction, under direction of the arborist, wounds should be cleaned, torn bark cut, and if possible the wounds dressed in a shape like a vertical ellipse, to facilitate rapid healing. Pruning knife shall be sharp and clean.
4. Unless directed otherwise by the arborist, any compacted soil within the critical root zone of the trees to be preserved shall be mechanically aerated to a depth of eight (8) inches. Aeration holes should be spaced one foot on center and should be positioned to avoid severing major roots.
5. The arborist shall inspect and review the trees within one-year after completion of construction and determine if the trees can be safely fertilized. The arborist shall make the initial fertilizer application and provide written instructions and information to the owner on successive fertilizer applications. After completion of construction the arborist shall perform Class II pruning on all trees to remove any damaged, dead, interfering and objectionable limbs ½ inch in diameter and larger. The arborist shall selectively thin the trees to properly shape the canopy, reduce wind resistance and the possibility of storm damage.

3.04 REMOVAL OF TEMPORARY STRUCTURES

A. Remove blaze orange fencing.

B. Re-seed or sod disturbed areas in accordance with the Contract Documents.

END OF SECTION

SECTION 32 9219
SEEDING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preparation of subsoil.

B. Placing topsoil.

C. Hydroseeding, mulching and fertilizer.

D. Maintenance.

1.02 RELATED REQUIREMENTS

A. Section 31 2200 - Grading: Topsoil material.

B. Section 31 2200 - Grading: Preparation of subsoil and placement of topsoil in preparation for the work of this section.

C. Section 31 2323 - Fill: Topsoil material.

D. Section 32 0190 - Operation and Maintenance of Planting: Post-occupancy maintenance.

E. Section 32 1125 - Turf Surfaced Aggregate Base Course: Additional seeding requirements.

1.03 PRICE AND PAYMENT PROCEDURES

A. See Section 01 2200 - Unit Prices, for additional unit price requirements.

B. Topsoil:

1. Basis of Measurement: By the cubic yard (meter).

2. Basis of Payment: Includes topsoil, placing topsoil.

C. Grassed Areas:

1. Basis of Measurement: By the square yard (meter).

2. Basis of Payment: Includes preparation of subsoil, placing topsoil, seeding, watering and maintenance to specified time limit.

1.04 DEFINITIONS

A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Topsoil samples.

C. Certificate: Certify seed mixture approval by authority having jurisdiction.

D. Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer .

E. Maintenance Contract.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable. Deliver seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.07 QUALITY ASSURANCE

A. Applicable Standards:

1. Federal Seed Act: Rules and Regulations.

B. Seed and Labeling Certification:

1. Ship all seed and other materials with certificates of inspection required by governing authorities. Make sure seed and certification complies with regulations applicable to such materials.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

B. Provide certificate of compliance from authority having jurisdiction indicating approval of seed mixture.

2.02 SEED MIXTURE

A. Seed Mixture:

2.03 SOIL MATERIALS

A. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay or impurities, plants, weeds and roots; pH value of minimum 5.4 and maximum 7.0.

2.04 ACCESSORIES

A. Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.

B. Fertilizer: ; recommended for grass, with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil, as indicated by analysis.

C. Water: Clean, fresh and free of substances or matter that could inhibit vigorous growth of grass.

D. Erosion Fabric: Jute matting, open weave.

E. Herbicide:

F. Stakes: Softwood lumber, chisel pointed.

G. String: Inorganic fiber.

H. Edging: Galvanized steel.

2.05 TESTS

A. Provide analysis of topsoil fill under provisions of Section 01 4000.

B. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.

C. Submit minimum 10 oz (280 g) sample of topsoil proposed. Forward sample to approved testing laboratory in sealed containers to prevent contamination.

D. Testing is not required if recent tests are available for imported topsoil. Submit these test results to the testing laboratory for approval. Indicate, by test results, information necessary to determine suitability.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared soil base is ready to receive the work of this Section. Proceeding with work assumes acceptance for existing conditions.

B. When conditions are such by reason of drought, excessive moisture, frozen soil or when in the opinion of the owner's representative less than satisfactory results are likely to be obtained, seeding work shall be halted as directed by the owner's representative and resumed only when conditions are favorable or when approved alternative or corrective measures and procedures have been enacted.

C. The contractor is to proceed with complete seeding work as rapidly as portions of the site become available, working within seasonal limitations. In any event, seeding shall be accomplished before the prepared seedbed becomes eroded, crusted over, or dried out and shall not be conducted when the ground is frozen or snow covered.

3.02 PREPARATION

A. Prepare subgrade in accordance with Section 31 2200.

B. Place topsoil in accordance with Section 31 2200.

C. Install edging at periphery of seeded areas in straight lines to consistent depth.

3.03 FERTILIZING

A. Apply fertilizer in accordance with manufacturer's instructions.

B. Apply after smooth raking of topsoil and prior to roller compaction.

C. Do not apply fertilizer at same time or with same machine as will be used to apply seed.

D. Mix thoroughly into upper 2 inches (50 mm) of topsoil.

E. Lightly water to aid the dissipation of fertilizer.

3.04 SEEDING

A. Apply seed at a rate determined by Architect evenly in two intersecting directions. Rake in lightly.

B. Do not seed areas in excess of that which can be mulched on same day.

C. Planting Season:

D. Do not sow immediately following rain, when ground is too dry, or during windy periods.

E. Roll seeded area with roller not exceeding 112 lbs (50 Kg).

F. Immediately following seeding and compacting, apply mulch to a thickness of 1/8 inches (3 mm). Maintain clear of shrubs and trees.

G. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches (100 mm) of soil.

H. Following germination, immediately re-seed areas without germinated seeds that are larger than 4 by 4 inches (100 by 100 mm).

3.05 HYDROSEEDING

A. Apply seeded slurry with a hydraulic seeder at a rate identified by Architect evenly in two intersecting directions.

B. Do not hydroseed area in excess of that which can be mulched on same day.

C. Immediately following seeding, apply mulch to a thickness of 1/8 inches (3 mm). Maintain clear of shrubs and trees.

D. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches (100 mm) of soil.

E. Following germination, immediately re-seed areas without germinated seeds that are larger than 4 by 4 inches (100 by 100 mm).

3.06 PROTECTION

A. Identify seeded areas with stakes and string around area periphery.

B. Cover seeded slopes where grade is 4 inches per foot ([____] mm per m) or greater with erosion fabric. Roll fabric onto slopes without stretching or pulling.

C. Lay fabric smoothly on surface, bury top end of each section in 6 inch (150 mm) deep excavated topsoil trench. Provide 12 inch (300 mm) overlap of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil.

D. Secure outside edges and overlaps at 36 inch (900 mm) intervals with stakes.

E. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.

F. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches (150 mm).

3.07 RECONDITIONING EXISTING AREAS

A. Exisitng areas damaged by the contractor's operations (e.g., contractor's storage or staging areas) including storage of materials and equipment, and movement of vehicles, are to be reconditioned. The contractor is also to recondition existing grass areas where minior regrading is required.

B. Contractor is to provide fertilizer, seed, lime and mulch as required for reconditioned areas as well as new soil as may be required to fill low spots to finished grade, at no additional cost to the owner.

C. The contractor shall rip or chisel all disturbed areas to a depth of twelve (12) inches, unless otherwise directed by the owner's representative.

D. Contractor is to remove diseaded and unsatisfactory grass areas. These grasses shall be buried in the soil at a depth of at least one (1) foot. Contractor shall remove topsoil containing foreign materials resulting from the contractor's operation including oil drippings, stone, gravel, and other materials as directed by the owner's representative.

E. Where substantial grass remains (but is thin) the contractor shall mow, rake, aerate (if compacted), fill low spots, remove humps, cultivate, fertilize, seed and mulch in accordance with these specifications.

3.08 FIELD QUALITY CONTROL

A. The owner's representative shall ensure that the contractor follows all seeding specifications and that seed mixes are planted in appropriate areas. The owner's representative shall:

1. Inspect and remove all company seed tickets from seed bags to ensure the quantity and quality of seed is adequate and that the proper mixture and species are planted. Seed without bag tags or company certification shall not be planted and will be replaced at no cost to the owner.

2. Ensure all soil ammendments meet specification for quantity and quality. No payment shall be made for ammendments or products that do not meet specifications.

3. Ensure all specificed seed methods are followed. No payment shall be made for seed that does not meet specifications.

4. Ensure all areas are planted and seeded with the appropriate seed mixtures. No payment shall be made for seeding work that does not meet specifications.
5. Ensure all rutted or damaged areas are smothered, repaired and seeded. No payment shall be made until all such areas are repaired.

B. If the contractor does not meet specified methods or use specified materials, the owner's representative shall take appropriate action. Any seeding methods that do not meet specifications will not be paid for by the owner or time extension to the contract.

C. If the work or materials do not meet specification, the contractor shall be responsible to replace material, work or make repairs at no cost to the owner or time extension to the contract.

3.09 MAINTENANCE

A. See Section 32 0190 - Operation and Maintenance of Planting for post-occupancy maintenance.

B. Maintain seeded areas immediately after placement until grass is well established and exhibits a vigorous growing condition.

END OF SECTION

SECTION 32 9223
SODDING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preparation of subsoil.

B. Placing topsoil.

C. Fertilizing.

D. Sod installation.

E. Maintenance.

1.02 RELATED REQUIREMENTS

A. Section 31 2200 - Grading: Topsoil material.

B. Section 31 2200 - Grading: Preparation of subsoil and placement of topsoil in preparation for the work of this section.

C. Section 31 2323 - Fill: Topsoil material.

D. Section 32 0190 - Operation and Maintenance of Planting: Post-occupancy maintenance.

E. Section 32 1125 - Turf Surfaced Roadways: Additional sodding requirements.

1.03 DEFINITIONS

A. Weeds: Includes Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.04 REFERENCE STANDARDS

A. TPI (SPEC) - Guideline Specifications to Turfgrass Sodding 2006.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Certificate: Certify grass species and location of sod source.

C. Certificate: Certify fertilizer and herbicide mixture approval by authority having jurisdiction.

D. Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer .

E. Maintenance Contract.

1.06 QUALITY ASSURANCE

A. Sod Producer: Company specializing in sod production and harvesting with minimum five years experience, and certified by the State of Maryland.

B. Installer Qualifications: Company approved by the sod producer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver sod on pallets. Protect exposed roots from dehydration.

B. Do not deliver more sod than can be laid within 24 hours.

1.08 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide a separate maintenance contract for specified maintenance service.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

B. Provide certificate of compliance from authority having jurisdiction indicating approval of fertilizer and herbicide mixture.

2.02 MATERIALS

A. Sod: TPI (SPEC), Certified Turfgrass Sod quality; cultivated grass sod; type indicated in plant schedule on Drawings; with strong fibrous root system, free of stones, burned or bare spots; containing no more than 5 weeds per 1000 sq ft (100 sq m). Minimum age of 18 months, with root development that will support its own weight without tearing, when suspended vertically by holding the upper two corners.

1. Machine cut sod and load on pallets in accordance with TPI (SPEC) Guidelines.

B. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay, or impurities, plants, weeds and roots; pH value of minimum 5.4 and maximum 7.0.

C. Fertilizer: recommended for grass, with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil, as indicated by analysis.

D. Water: Clean, fresh and free of substances or matter that could inhibit vigorous growth of grass.

2.03 ACCESSORIES

A. Wood Pegs: Softwood, sufficient size and length to ensure anchorage of sod on slope.

B. Wire Mesh: Interwoven hexagonal metal wire mesh of 2 inch (50 mm) size.

C. Edging: Galvanized steel.

2.04 SOURCE QUALITY CONTROL

A. Provide analysis of topsoil fill under provisions of Section 01 4000.

B. Submit minimum 10 oz (280 g) sample of topsoil proposed. Forward sample to approved testing laboratory in sealed containers to prevent contamination.

C. Testing is not required if recent tests are available for imported topsoil. Submit these test results to the testing laboratory for approval. Indicate, by test results, information necessary to determine suitability.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared soil base is ready to receive the work of this section.

3.02 PREPARATION

A. Prepare subgrade in accordance with Section 31 2200.

B. Place topsoil in accordance with Section 31 2200.

C. Install edging at periphery of seeded areas in straight lines to consistent depth.

3.03 FERTILIZING

A. Apply fertilizer in accordance with manufacturer's instructions.

B. Apply after smooth raking of topsoil and prior to installation of sod.

C. Apply fertilizer no more than 48 hours before laying sod.

D. Mix thoroughly into upper 2 inches (50 mm) of topsoil.

E. Lightly water to aid the dissipation of fertilizer.

3.04 LAYING SOD

A. Moisten prepared surface immediately prior to laying sod.

B. Lay sod immediately after delivery to site to prevent deterioration.

C. Lay sod smooth and tight with no open joints visible, and no overlapping; stagger end joints 12 inches (300 mm) minimum. Do not stretch or overlap sod pieces.

D. Where new sod adjoins existing grass areas, align top surfaces.

E. Where sod is placed adjacent to hard surfaces, such as curbs, pavements, etc., place top elevation of sod 1/2 inch (13 mm) below top of hard surface.

F. On slopes 6 inches per foot (500 mm per m) and steeper, lay sod perpendicular to slope and secure every row with wooden pegs at maximum 2 feet (600 mm) on center. Drive pegs flush with soil portion of sod.

G. Prior to placing sod, on slopes exceeding 8 inches per foot (666 mm per m) or where indicated, place wire mesh over topsoil. Securely anchor in place with wood pegs sunk firmly into the ground.

H. Water sodded areas immediately after installation. Saturate sod to 4 inches (100 mm) of soil.

I. After sod and soil have dried, roll sodded areas to ensure good bond between sod and soil and to remove minor depressions and irregularities.

3.05 MAINTENANCE

A. Provide maintenance at no extra cost to Owner ; Owner will pay for water.

B. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

C. Provide maintenance of sodded areas for three months from Date of Substantial Completion.

D. Maintain sodded areas immediately after placement until grass is well established and exhibits a vigorous growing condition.

E. Mow grass at regular intervals to maintain at a maximum height of 2-1/2 inches (65 mm). Do not cut more than 1/3 of grass blade at any one mowing.

F. Neatly trim edges and hand clip where necessary.

G. Immediately remove clippings after mowing and trimming.

H. Water to prevent grass and soil from drying out.

I. Roll surface to remove irregularities.

J. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.

K. Immediately replace sod to areas that show deterioration or bare spots.

L. Protect sodded areas with warning signs during maintenance period.

END OF SECTION

SECTION 32 9300
PLANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preparation of subsoil.

B. Topsoil bedding.

C. New trees, plants and ground cover.

D. Relocated trees, plants and ground cover.

E. Mulch and Fertilizer.

F. Maintenance.

G. Tree Pruning.

1.02 RELATED REQUIREMENTS

A. Section 31 2200 - Grading: Topsoil material.

B. Section 31 2323 - Fill: Topsoil material.

C. Section 32 0190 - Operation and Maintenance of Planting: Post-occupancy maintenance.

1.03 DEFINITIONS

A. Weeds: Any plant life not specified or scheduled.

B. Plants: Living trees, plants, and ground cover specified in this Section , and described in ANSI Z60.1.

1.04 REFERENCE STANDARDS

A. ANSI/ANLA Z60.1 - American National Standard for Nursery Stock 2004.

B. ANSI A300 Part 1 - American National Standard for Tree Care Operations -- Tree, Shrub and Other Woody Plant Maintenance -- Standard Practices 2017.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Certificate: Certify fertilizer and herbicide mixture approval by authority having jurisdiction.

C. Certificate: Submit certificate for plants free of disease or hazardous insects; certified by federal department of agriculture; free of disease or hazardous insects.

D. Maintenance Data: Include cutting and trimming method ; types, application frequency, and recommended coverage of fertilizer .

E. Submit list of plant life sources.

F. Maintenance Contract.

1.06 QUALITY ASSURANCE

A. Nursery Qualifications: Company specializing in growing and cultivating the plants with three years documented experience.

B. Installer Qualifications: Company specializing in installing and planting the plants with five years experience.

C. Tree Pruner Qualifications: Company specializing in pruning trees with proof of Arborist Certification.

D. Tree Pruning: Conform to ANSI A300 Part 1.

E. Maintenance Services: Performed by installer.

F. Non-native, Invasive Plant Species: Do not introduce, grow, or cultivate plant species that are non-native to the ecosystem of the project site, and whose introduction causes or is likely to cause economic or environmental harm or harm to human health.

1. Conform to laws regulating non-native and invasive plant species in Maryland.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

B. Protect and maintain plant life until planted.

C. Deliver plant life materials immediately prior to placement. Keep plants moist.

1.08 FIELD CONDITIONS

A. Do not install plant life when ambient temperatures may drop below 35 degrees F (2 degrees C) or rise above 90 degrees F (32 degrees C).

B. Do not install plant life when wind velocity exceeds 30 mph (48 k/hr).

C. Coordination with Lawns: Plant trees and shrubs after finish grades are established and before planting lawns, unless otherwise acceptable to Architect.

1. When planting trees and shrubs after lawns, protect lawn areas and promptly repair damage caused by planting operations.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide one year warranty that shall commence at substantial completion.

C. Warranty: Include coverage for one continuous growing season; replace dead or unhealthy plants.

D. Replacements: Replace exterior plants that are more than 25 percent dead with plants of same size and species as specified, planted in the next growing season, with a new warranty commencing on date of replacement.

1.10 MAINTENANCE (SEE END OF SECTION)

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide a separate maintenance contract for specified maintenance service. Term to be defined by owner.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

B. Provide certificate of compliance from authority having jurisdiction indicating approval of plants, fertilizer and herbicide mixture.

C. Plant Materials: Certified by federal department of agriculture; free of disease or hazardous insects.

2.02 PLANTS

A. Plants: Species and size identified in plant schedule, grown in climatic conditions similar to those in locality of the work.

2.03 SOIL MATERIALS

A. Topsoil: Type as specified in Section 31 2200.

2.04 SOIL AMENDMENT MATERIALS

A. Fertilizer: Containing fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil, as indicated in analysis..

B. Peat Moss: Shredded, loose, sphagnum moss; free of lumps, roots, inorganic material or acidic materials; minimum of 85 percent organic material measured by oven dry weight, pH range of 4 to 5; moisture content of 30 percent.

C. Bone Meal: Raw, finely ground, commercial grade, minimum of 3 percent nitrogen and 20 percent phosphorous.

D. Lime: Ground limestone, dolomite type, minimum 95 percent carbonates.

E. Water: Clean, fresh, and free of substances or matter that could inhibit vigorous growth of plants.

2.05 MULCH MATERIALS

A. Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.

2.06 ACCESSORIES

A. Wrapping Materials: Burlap.

B. Stakes: Softwood lumber, pointed end.

C. Cable, Wire, Eye Bolts and Turnbuckles: Non-corrosive, of sufficient strength to withstand wind pressure and resulting movement of plant life.

D. Guy Stakes: Rough-sawn, sound, new hardwood, redwood, or pressure-preservativetreated softwood, free of knots, holes, cross grain, and other defects, 2 by 2 inches (50 by 50 mm) by length indicated, pointed at one end. Revise first paragraph below to 0.080-inch- (2-mm-) diameter wire for small trees. Select guy cable for tall and large caliper trees.

E. Plant Protectors: Rubber sleeves over cable to protect plant stems, trunks, and branches.

F. Guy and Tie Wire: ASTM A 641/A 641M, Class 1, galvanized-steel wire, 2-strand, twisted, 0.106 inch (2.7 mm) in diameter.

G. Grates: Cast iron, galvanized finish, with grillage design, diameter, sized to resist pedestrian loads.

H. Membrane: 20 mil (0.5 mm) thick, clear polyethylene.

I. Wrapping: Waterproof fabric.

J. Tree Protectors: Metal with galvanized rings.

2.07 TOP SOIL MIX

A. A uniform mixture of 1 part peat and 3 parts topsoil by volume.

2.08 SOURCE QUALITY CONTROL

A. Provide analysis of topsoil; comply with requirements of Section 01 4000.

B. Provide testing of imported topsoil.

C. Submit minimum 10 oz (280 g) sample of topsoil proposed. Forward sample to testing laboratory in sealed containers to prevent contamination.

D. Testing is not required if recent tests are available for imported topsoil. Submit these test results to the testing laboratory for approval. Indicate, by test results, information necessary to determine suitability.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared subsoil and planters are ready to receive work.

B. Saturate soil with water to test drainage.

C. Examine areas to receive exterior plants for compliance with requirements and conditions affecting installation and performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION OF SUBSOIL

A. Protect structures, utilities, sidewalks, pavements, and other facilities, and lawns and existing exterior plants from damage caused by planting operations.

B. Prepare subsoil to eliminate uneven areas. Maintain profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

C. Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated subsoil.

D. Scarify subsoil to a depth of 3 inches (75 mm) where plants are to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted subsoil.

E. Dig pits and beds 6 inches (150 mm) larger than plant root system.

3.03 PLACING TOPSOIL

A. Spread topsoil to a minimum depth of 4 inches (100 mm) over area to be planted. Rake smooth.

B. Place topsoil during dry weather and on dry unfrozen subgrade.

C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.

D. Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.

E. Install topsoil into pits and beds intended for plant root balls, to a minimum thickness of 6 inches (150 mm).

3.04 FERTILIZING

A. Apply fertilizer in accordance with manufacturer's instructions.

B. Apply after initial raking of topsoil.

C. Mix thoroughly into upper 2 inches (50 mm) of topsoil.

D. Lightly water to aid the dissipation of fertilizer.

3.05 PLANTING

A. Place plants for best appearance for review and final orientation by Architect .

B. Set plants vertical.

C. Remove non-biodegradable root containers.

D. Set plants in pits or beds, partly filled with prepared plant mix, at a minimum depth of 6 inches (of 150 mm) under each plant. Remove burlap, ropes, and wires, from the root ball.

E. Place bare root plant materials so roots lie in a natural position. Backfill soil mixture in 6 inch (150 mm) layers. Maintain plant life in vertical position.

F. Saturate soil with water when the pit or bed is half full of topsoil and again when full.

3.06 PLANT RELOCATION AND RE-PLANTING

A. Relocate plants as indicated by Architect .

B. Replant plants in pits or beds, partly filled with prepared topsoil mixture, at a minimum depth of 6 inches (of 150 mm) under each plant. Remove burlap, ropes, and wires, from the root ball.

C. Place bare root plant materials so roots lie in a natural position. Backfill soil mixture in 6 inch (150 mm) layers. Maintain plant materials in vertical position.

D. Saturate soil with water when the pit or bed is half full of topsoil and again when full.

3.07 INSTALLATION OF ACCESSORIES

A. Place decorative cover and membrane, where indicated on drawings.

B. Place grates at base of trees where indicated on drawings.

C. Wrap deciduous shade and flowering tree trunks and place tree protectors.

3.08 PLANT SUPPORT

A. Brace plants vertically with plant protector wrapped guy wires and stakes to the following:

1. Tree Caliper: 1 to 2 inches (25 to 50 mm); Tree Support Method: 2 stakes with two ties
2. Tree Caliper: 2 to 4 inches (50 to 100 mm); Tree Support Method: 3 guy wires with eye bolts and turn buckles
3. Tree Caliper: Over 4 inches (100 mm); Tree Support Method: 4 guy wires with eye bolts and turn buckles

3.09 TREE PRUNING

A. Prune trees as recommended in ANSI A300 Part 1.

B. Prune newly planted trees as required to remove dead, broken, and split branches.

3.10 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01 4000.

B. Plants will be rejected if a ball of earth surrounding roots has been disturbed or damaged prior to or during planting.

3.11 MAINTENANCE

A. Provide maintenance at no extra cost to Owner ; Owner will pay for water.

B. Provide a separate maintenance contract for specified maintenance service.

C. Irrigate sufficiently to saturate root system and prevent soil from drying out.

D. Cultivate and weed plant beds and tree pits.

E. Remove dead or broken branches and treat pruned areas or other wounds.

F. Neatly trim plants where necessary.

G. Immediately remove clippings after trimming.

H. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions.

I. Control insect damage and disease. Apply pesticides in accordance with manufacturers instructions.

J. Remedy damage from use of herbicides and pesticides.

K. Replace mulch when deteriorated.

L. Maintain wrappings, guys, turnbuckles, and stakes. Adjust turnbuckles to keep guy wires tight. Repair or replace accessories when required.

END OF SECTION

SECTION 32 9600
REFORESTATION PLANTING TREES AND SHRUBS

PART 1 – GENERAL:

1.01 DESCRIPTION OF WORK:

A. Description of work: Work of this section includes, but is not limited to, the following:

1. Trees and shrubs
2. Backfill mixtures.
3. Mulching and planting accessories.
4. Warranty and maintenance.
5. Implementing measures to prevent wildlife injury and depredation.

1.02 RELATED WORK:

A. Coordinate with the earthwork and appropriate site specifications for proper scheduling for the performance of the work specified herein.

1. Section 31 20 00: Earthmoving
2. Section 32 90 00: Tree Conservation
3. Section 32 93 05: Lawns and Grasses

1.03 QUALITY ASSURANCE:

A. Installer shall have not less than 5 years documented successful experience in installation of work similar to work of this Project and be a member of one of the following organizations:

1. Landscape Contractors Association.
2. American Nursery and Landscape Association.
3. Maryland Nurserymen’s Association.

1.04 SUBMITTALS:

A. Product Data:

1. Submit manufacturer’s data and source data for materials including soils.
2. Submit manufacturer’s data and source data for materials for weed control and wildlife control.
3. Submit location of product manufacture and harvest of primary raw materials.

B. Schedules:

1. Submit schedule listing plants to be provided.
2. Submit maintenance schedule for watering and wildlife control measures.

C. Samples:

1. Submit to the Landscape Architect for review, one-pound (1lb.) samples packaged in plastic bags of mulch, topsoil, and soil mixes for all planting pits.
2. Provide samples typical of material used in Project with same color texture, and organic composition.

D. Test Reports:

1. Submit soil analysis of both soil mixes and topsoil, stating pH, nutrient levels (N.P.K), % organic matter, and mechanical analysis prepared by qualified soil testing lab along with samples. Test and

Reports shall be paid for by the Contractor.

E. Qualification Data:

1. Submit installer qualifications verifying years of experience; include list of completed projects having similar scope of work identified by name, location, date, reference names and phone numbers.

F. Warranty and Maintenance:

1. Submit written warranty and maintenance agreement for materials as specified.

1.05 WARRANTY AND MAINTENANCE AGREEMENT:

A. All plants shall be guaranteed to remain alive and healthy for five full years after initial acceptance.

B. Inspection and Initial Acceptance:

1. Initial acceptance shall be defined as approval, by the M-NCPPC or Landscape Architect, of the complete landscape installation immediately after planting.

2. Contractor shall notify M-NCPPC and Landscape Architect, in writing, of project completion and request an inspection within two weeks.

3. If the plant material and workmanship are satisfactory, the Landscape Architect will give written notice to that effect. This will constitute the Certificate of Acceptance, and the warranty period will begin from that date.

4. Care of the plant material shall begin immediately after each plant item is satisfactorily installed and shall continue through the entire life of the contract. During this time, the Contractor shall do all work which is necessary to establish and keep the plants alive and healthy.

1.06 FINAL INSPECTION:

A. The Contractor will conduct a final Inspection with the Landscape Architect at the end of the five-year period. It will be the Contractors responsibility to notify the M-NCPPC and Landscape Architect within two weeks of the anticipated meeting.

B. Any material that is 25% dead or more shall be considered dead and must be replaced at no charge. A tree shall be considered dead when the main leader has died back or there is 25% of the crown dead.

C. Deciduous material will be guaranteed to break dormancy if planted in dormant season.

1.07 REPLACEMENTS AND CONDITIONS

A. Replacements will be made during the next appropriate planting period.

B. The Contractor shall be responsible for replacements as required to provide 200 live trees 1" or greater in diameter per acre, in satisfactory condition at the end of the five year warranty period.

C. Replacements will be of the same size and species as the original with no additional soil amendments to be used. Native plant material substitutions may be permitted if requested in writing and approved by the M-NCPPC.

D. The Contractor will not be responsible for plant material that has been damaged due to vandalism, fire, relocation or other activities beyond the contractor’s control.

E. Plant losses due to abnormal weather conditions such as floods, excessive wind, or severe freezing will not be the responsibility of the contractor.

F. Plant losses or damage due to wildlife depredation or foraging shall be the responsibility of the contractor during the five year warranty period.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide products manufactured and of raw materials extracted/recovered within a 500-mile radius of the Project Site.

2.02 TREES, SHRUBS AND GROUNDCOVERS

A. Topsoil: New topsoil shall be good friable, natural loam topsoil, containing no subsoil material, free of sticks, stones, roots, weeds, debris or other extraneous matter, and shall be obtained from an area that has never been stripped and shall have an acidity range of pH 5.0 to pH 7.0.

B. Soil Mix: Soil mix shall be 50% topsoil, 25% sand and 25% leaf mulch organic matter.

C. Fertilizer: Fertilizer for planting areas and tree pits shall be approximately 5-10-5, and organically derived.

D. Mulch: Mulch for groundcover areas shall be dark brown, shredded hardwood bark, or approved equal.

E. Stakes: Stakes shall be 2” x 2” x 8’ wood timbers.

F. Guy Wires and Turnbuckles (if needed); Guy wire shall be No. 14 gage galvanized steel wire: turnbuckles shall be galvanized, 1/2’ diameter. bolt size with closed eyes to receive guy wires. The use of ArborTie by Deep Root Partner, LLP is an acceptable alternative for the wire guy and hose collar.

G. Rubber Hose: Rubber hose shall be ¾” black corded hose. The use of ArborTie by Deep Root Partner, LLP is an acceptable alternative for the wire guy and hose collar.

H. Tree Trunk Protector: The tree trunk protector shall consist of 4" diameter ADS flexible drainage pipe or approved equal. The tree trunk protector shall extend from the top of the root ball to the lowest branch of the tree or 5 feet which ever is greater. ADS flex pipe or approved equal shall be split to wrap around tree trunk to prevent damage.

I. Plant Material

1. Plant List: The Contractor shall be responsible for furnishing and installing all plant material shown on the drawings. Contractor shall verify all quantities to his own satisfaction prior to bidding. Any discrepancies shall be reported to the Landscape Architect immediately.

2. Nomenclature: The names of plants required under this contract conform to those given in Hortus III, 1979 Edition.

3. The Contractor shall have investigated the sources of supply and satisfied himself that he can supply all of the plants specified on the plant list in the size, variety and quality noted prior to submitting his bid. Failure to take this precaution will not relieve the successful bidder from his responsibility for furnishing and installing all the plant material in strict accordance with the contract requirements and without additional expense to the owner. Substitutions will not be permitted unless approved by the MNCP&PC and Landscape Architect. If proof is submitted that any plant specified is not obtainable, a proposal will be considered for use of nearest equivalent size or variety with an equitable adjustment of contract price. Such proof shall be substantiated and submitted in writing to the Landscape Architect.

4. All plants shall comply with the recommendations and requirements of ANSI Z60.1-1996 “American Standard for Nursery Stock”.

5. Rejection: Any materials and/or work may be rejected if in the opinion of the Landscape Architect such does not meet the requirements of the specifications. All rejected materials shall be removed from the site by the Contractor within 45 hours.

6. Size: All trees and shrubs shall be measured when their branches are in their normal position. Height and spread dimensions specified refer to the main body of the plant and not from branch or root tip to tip. The determining measurement for trees shall be caliper, which shall be taken six (6”) inches above the ground for trees up to four (4”) inches in caliper. All plants shall conform to the measurements specified in the plant lists except that plants larger than specified may be used if

approved by the Landscape Architect. Use of such plants shall not increase the contract price. If larger plants are approved, the size of the root ball shall be increased in proportion to the size of the plant.

7. All “matched” species shall be from the same nursery source and nursery lot location.

PART 3 – EXECUTION:

3.01 EXAMINAT1ON OF SITES:

A. The Contractor shall examine the site and all conditions thereon, and take into consideration all such conditions that may affect his work. Start of work indicates acceptance of conditions and full responsibility for work of this section.

B. The Contractor shall be responsible to coordinate his work and access with the other site contractors for the construction projects on the property.

3.02 PERSONNEL:

A. The work shall be performed by personnel familiar with the planting procedures under the supervision of qualified foremen.

3.03 PLANT INSPECTION:

A. All plants shall be subject to inspection by the Landscape Architect for species, size, color, and quality. If so desired, a sample for each plant variety (tree, shrub, groundcover) shall be planted as specified. Once approved, these samples shall be tagged by the Contractor and used as standards of comparison for the remainder of the Work. Plant inspection shall be arranged by the Contractor at least one week prior to planting.

B. Photographs of any material that is coming from suppliers outside the immediate project area may be submitted as typical samples for pre-approval.

3.04 PROTECTION AND REPAIR:

A. All portions of the property, which have been disturbed or damaged due to, or incidental to, work performed under this contract shall be repaired and restored to its original condition to the satisfaction of the Landscape Architect.

B. The Contractor shall fully and satisfactorily maintain and protect all work until completion and acceptance of all work or portions thereof and shall repair or replace, at his expense, any work damaged during that period, to the satisfaction of the Landscape Architect.

C. All work must be contained within the prescribed limits of disturbance shown on the contract documents.

3.05 CLEANUP:

A. At all times during the progress of the work, the contractor shall maintain the site in an orderly condition. Streets and pavements shall be kept clean. Materials and equipment for planting work shall be limited to the quantity required for the work. All rejected materials shall be immediately removed from the site.

3.06 TIMING:

A. Planting work shall not be started until final grades have been established and approved by the Landscape Architect.

B. Under no conditions shall any work be done if weather or soil conditions are not satisfactory.

C. The season for planting trees, shrubs and groundcover shall be March 15 to June 1 and September 15 to November 15, unless otherwise approved by the Landscape Architect. Any out of season planting will be fully guaranteed by the Contractor.

3.07 DIGGING AND HANDLING PLANT MATERIAL:

A. No plants shall be dug or delivered to the site until the required inspections have been made and the plants approved.

B. Balled and burlapped (B&B) plants shell be dug with firm, natural balls of earth, of diameter and sufficient depth to include the fibrous and feeding roots. No plants will be accepted if the ball is cracked or broken before or during planting operations.

C. Roots or balls of all plants shall be adequately protected at all times from sun and/or drying winds. Balled and burlapped plants that cannot be planted immediately upon delivery or collection from the site shall be set on the ground and protected with soil, wet peat or other acceptable material.

D. No plant shall be bound with wire or rope at any time so as to damage the bark or break branches.

E. Plants shall be pruned only as directed by the Landscape Architect.

3.08 PLANTING PITS:

A. Tree locations shall be staked by the Contractor and approved by the Landscape Architect before planting; all planting areas shall be excavated to depths and dimensions indicated; all unsuitable subsoil shall be removed from the site.

B. The sides and bottom of all planting beds shall be scarified.

C. Planting beds shall be backfilled with specified soil mix and hand compacted.

D. Fertilizer shall be mixed thoroughly into the full depth of all planting areas.

3.09 PLANTING:

A. Setting Plants:

1. Unless otherwise specified, all plants shall be planted in pits, centered and set on prepared soil to such depth that 1/8 of the root ball is above grade. Plants shall be planted upright and faced to give the best appearance or relationship to adjacent structures.

2. No burlap shall be pulled out from under balls. Platforms, wire and surplus binding from top and sides of the ball shall be removed. All broken or frayed roots shall be cut off cleanly.

3. When trees are delivered in wire baskets, the wire baskets shall be cut down the side of each mesh and peeled away from the rootball and removed in entirety.

4. Topsoil shall be placed and compacted carefully to avoid injury to roots and to fill all voids. When the hole is nearly filled, water shall be added as necessary and allowed to soak in. The hole shall be filled to finished grade and a shallow saucer shall be formed around each plant by placing a ridge of soil around the edge of each pit. After the ground settles, additional soil shall be filled into the pit to reach the level of the finished grade.

5. After all backfill has been placed, water thoroughly on the interior of the tree saucer until it is filled, even if it is raining.

B. Plant Locations: Plants shall be located as indicated on the contract drawings. All locations are to be approved by the Landscape Architect before any excavation is started.

C. Obstructions: All utilities shall be located in the field before any digging is begun. Any disruption or damage to utility lines shall be the responsibility of the Contractor.

D. Pruning: Only dead and broken branches shall be removed from trees unless otherwise directed by the Landscape Architect. Plant material shall be pruned in accordance with standard horticultural practice to preserve the natural character of the plant. Only clean sharp tools shall be used.

E. Mulching and Staking: All trees shall be staked and mulched with a 2-inch layer of shredded hardwood bark within the entire area of the planting pit. Mulch shall be placed within 48 hours of planting. All shrubs

shall be mulched with a 2-inch layer of shredded hardwood bark within the entire area of the planting pit. Mulch shall be placed within 48 hours of planting.

F. Clean-Up: No debris shall be left on-site. Excavated materials shall be removed or disposed of per Landscape Architect's instructions.

3.10 MAINTENANCE OF PLANT MATERIALS

A. DESCRIPTION:

1. Maintenance shall begin immediately after each plant is installed. The landscape contractor shall provide all materials, labor and equipment to complete all landscape maintenance work for the two-year warranty period.

B. STANDARDS:

1. All landscape maintenance services shall be performed by trained personnel using current, acceptable horticultural practices.
2. All work shall be performed in a manner, which maintains the original intent of the landscape design.
3. All chemical applications shall be performed in accordance with current county, state and federal laws, utilizing EPA-approved materials and methods of application. These applications shall be performed under the supervision of a Licensed Certified applicator.

C. WORKMANSHIP:

1. During landscape maintenance operations, all areas shall be kept neat and clean. Precautions shall be taken to avoid damage to existing structures. All work shall be performed in a safe manner to the operators, the occupants and pedestrians.
2. Upon completion of maintenance operations, all debris and waste materials shall be cleaned up and removed from the site, unless provisions have been granted by the owner to utilize on-site trash receptacles.
3. Any damage to the site caused by the Landscape Contractor shall be repaired by the Landscape Contractor without charge to the Owner.

D. TREES, SHRUBS & GROUNDCOVERS:

1. Pruning: All ornamental trees, shrubs shall be pruned when appropriate to remove dead or damaged branches, develop the natural form of the plant.
2. Weeding: All beds shall be weeded on a continuous basis throughout the growing season to maintain a neat appearance at all times.
3. Insect and Disease Control: The Landscape Contractor shall be responsible for monitoring the site conditions on each visit to determine if any insect or disease problems exist. Immediate measures shall be taken to eliminate any disease or infestation problems.
4. Trash Removal: The Landscape Contractor shall remove trash from all groundcover beds with each visit.
5. Winter Clean Up: Project shall receive a general clean up once during each of the winter months (January, February, March) to include: Removing all trash and unwanted debris, turning mulch where necessary, and inspection of grounds.
6. Watering: The Landscape Contractor shall be responsible for watering all plant material as necessary throughout the growing season for the two year warranty period. A water supply shall be made available on the site for the Contractor to use. The Contractor shall have the option to install a temporary drip irrigation system, install water bags ("TREEGATOR" units) or perform watering by dragging hose to water plants individually. If a temporary drip irrigation system is used the

contractor shall be responsible for all temporary plumbing connections, back-flow preventers and devices required by the plumbing code.

7. Fertilizing: A slow release fertilizer of 5-10-5 shall be applied to all plant material at the end of the 5 yr. maintenance period.
8. Miscellaneous:
    a. Mulch areas of all planting beds and tree pits shall be maintained at a 2” level.
    b. Plants shall be reset to proper grade or upright position as necessary. Stakes and guys shall also be adjusted as necessary.
    c. The Contractor shall prepare maintenance guidelines for use by the Owner.
    d. All stakes and guys shall be removed by the Contractor at the end of five- years unless instructed in writing to leave the stakes and guys in place.
    e. Cut back tops of perennials. Dead tops of all perennials shall be cut back in February and the tops removed. Care shall be taken not to damage plants.

3.11 ACCEPTANCE:

A. Final acceptance of the work by the Owner will be contingent on Contractor’s compliance, with warranty and replacement requirements and Landscape Architect’s approval. The Landscape Architect will notify the Owner within one week of final inspection.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Disinfection of site domestic water lines and site fire water lines specified in Section 33 1416.

B. Disinfection of building domestic water piping specified in Section 22 1005.

C. Disinfection of water storage tanks.

D. Testing and reporting results.

1.02 RELATED REQUIREMENTS

A. Section 22 1005 - Plumbing Piping: Disinfection of building domestic water piping system.

B. Section 33 1416 - Site Water Utility Distribution Piping.

C. Section 33 1113 - Potable Water Supply Wells.

D. WSSC General Conditions, Standard Specifications, Details, and Templates for Construction

1.03 REFERENCE STANDARDS

A. AWWA B300 - Hypochlorites 2010, Addendum 2011.

B. AWWA B301 - Liquid Chlorine 2010.

C. AWWA B302 - Ammonium Sulfate 2016.

D. AWWA B303 - Sodium Chlorite 2010.

E. AWWA C651 - Disinfecting Water Mains 2014.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Test Reports: Indicate results comparative to specified requirements.

C. Certificate: From authority having jurisdiction indicating approval of water system.

D. Certificate: Certify that cleanliness of water distribution system meets or exceeds specified requirements.

E. Disinfection report:

1. Type and form of disinfectant used.
2. Date and time of disinfectant injection start and time of completion.
3. Test locations.
4. Initial and 24 hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
5. Date and time of flushing start and completion.
6. Disinfectant residual after flushing in ppm for each outlet tested.

F. Bacteriological report:

1. Date issued, project name, and testing laboratory name, address, and telephone number.
2. Time and date of water sample collection.
3. Name of person collecting samples.
4. Test locations.

5. Initial and 24 hour disinfectant residuals in ppm for each outlet tested.
6. Coliform bacteria test results for each outlet tested.
7. Certification that water conforms, or fails to conform, to bacterial standards of Clean Water Act for MD.

1.05 QUALITY ASSURANCE

A. Water Treatment Firm: Company specializing in disinfecting potable water systems specified in this Section with minimum three years documented experience.

B. Testing Firm: Company specializing in testing potable water systems, certified by WSSC.

C. Submit bacteriologist's signature and authority associated with testing.

D. Source Quality Assurance:

1. Perform work in connection with disinfection under direction of experienced supervisor.
2. Use equipment in proper working condition and adequate for specified work.

PART 2 PRODUCTS

2.01 DISINFECTION CHEMICALS

A. Chemicals: AWWA B300 Hypochlorite, AWWA B301 Liquid Chlorine, AWWA B302 Ammonium Sulfate and AWWA B303 Sodium Chlorite, or other material as approved by WSSC.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping system and water well has been cleaned, inspected , and pressure tested.

B. Schedule disinfecting activity to coordinate with start-up, testing, adjusting and balancing, demonstration procedures, including related systems.

3.02 DISINFECTION

A. Use method prescribed by the applicable state or local codes, or health authority or water purveyor having jurisdiction, or in the absence of any of these follow AWWA C651.

B. Provide and attach equipment required to perform the work.

C. Inject treatment disinfectant into piping system.

D. Maintain disinfectant in system for 24 hours.

E. Flush, circulate, and clean until required cleanliness is achieved; use municipal domestic water.

F. Replace permanent system devices removed for disinfection.

G. Pressure test system to standards identified by WSSC. Repair leaks and re-test.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01 4000.

B. Test samples in accordance with AWWA C651.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Monolithic concrete manholes with masonry transition to lid frame, covers, anchorage, and accessories.

B. Modular precast concrete manhole sections with tongue-and-groove joints with masonry transition to lid frame, covers, anchorage, and accessories.

C. Masonry manhole sections with masonry transition to lid frame, covers, anchorage, and accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

B. Section 04 0511 - Mortar and Masonry Grout.

C. Section 04 2000 - Unit Masonry: Masonry units.

1.03 REFERENCE STANDARDS

A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries 2013.

B. ASTM A48/A48M - Standard Specification for Gray Iron Castings 2003 (Reapproved 2016).

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

D. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete 2017.

E. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete 2010a (Reapproved 2016).

F. ASTM C478 - Standard Specification for Circular Precast Reinforced Concrete Manhole Sections 2015a.

G. ASTM C478M - Standard Specification for Circular Precast Reinforced Concrete Manhole Sections (Metric) 2015a.

H. ASTM C923M - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals (Metric) 2018.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manhole covers, component construction, features, configuration, and dimensions.

C. Shop Drawings: Indicate manhole locations, elevations, piping sizes and elevations of penetrations.

D. Manufacturer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.06 FIELD CONDITIONS

A. Cold and Hot Weather Requirements: Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

2.01 MATERIALS

A. Manhole Sections: Reinforced precast concrete in accordance with ASTM C478 (ASTM C478M), with resilient connectors complying with ASTM C923 (ASTM C923M).

B. Concrete: As specified in Section 03 3000.

C. Clay Brick Units: ASTM C62, Grade SW solid units; nominal modular size of 2-1/4 x 3-5/8 x 7-5/8 in (28 x 92 x 194 mm).

D. Mortar and Grout: As specified in Section 04 2000, Type S.

E. Reinforcement: Formed steel wire, galvanized finish, wire diameter as indicated on drawings.

F. Concrete Reinforcement: As specified in Section 03 3000.

G. Admixtures, General: Chemical type conforming to ASTM C494/C494M (wet mix only).

H. Air-Entraining Admixture: Conforming to ASTM C260/C260M (wet mix only).

I. Microbiologically-Induced Corrosion-Inhibiting Admixture: Resists growth of bacteria and fungi on or inside concrete.

2.02 COMPONENTS

A. Lid and Frame: ASTM A48/A48M Class 30B Cast iron construction, machined flat bearing surface, removable lockable lid, closed lid design; sealing gasket; lid molded with identifying name.

B. Manhole Steps: Formed galvanized steel rungs; 3/4 inch (19 mm) diameter. Formed integral with manhole sections.

C. Strap Anchors: Bent steel shape, galvanized to ASTM A123/A123M Grade specified for applicable material category.

2.03 CONFIGURATION

A. Shaft Construction: Concentric with concentric cone top section; lipped male/female dry joints; sleeved to receive pipe sections.

B. Shape: Cylindrical.

C. Pipe Entry: Provide openings as indicated.

D. Steps: 12 inches (300 mm) wide, 16 inches (400 mm) on center vertically, set into manhole wall.

E. Steps: As required by code.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify items provided by other sections of Work are properly sized and located.

B. Verify that built-in items are in proper location, and ready for roughing into Work.

C. Verify excavation for manholes is correct.

3.02 PREPARATION

A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

B. Protect structures, utilities, sidewalks, pavements, benchmarks, survey control points, and other facilities from damage caused by excavation equipment and any settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

C. Protect and maintain erosion and sedimentation controls during earth moving operations.

D. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection and all frost damaged soils before placing subsequent materials.

E. Perform all excavations in accordance with current OSHA safety requirements. Excavation side slope support shall be provided using soldier piles and lagging, where necessary.

F. Notify all utility companies prior to excavation, in accordance with Prince George's County regulations.

G. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

H. Do not install structures where site conditions induce loads exceeding structural capacity of structures.

I. Inspect precast concrete structures immediately prior to placement in excavation to verify structures are internally clean and free from damage. Remove and replace damaged units.

3.03 MANHOLES

A. Place concrete base pad, trowel top surface level.

B. Place manhole sections plumb and level, trim to correct elevations, anchor to base pad.

C. Form and place manhole cylinder plumb and level, to correct dimensions and elevations. As work progresses, build in fabricated metal items.

D. Cut and fit for pipe.

E. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour as required.

F. Set cover frames and covers level without tipping, to correct elevations.

G. Coordinate with other sections of work to provide correct size, shape, and location.

3.04 MASONRY WORK

A. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

B. Lay masonry units in running bond. Course one unit and one mortar joint to equal 8 inches (200 mm).

C. Form concave mortar joints.

D. Lay masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

E. Install joint reinforcement 16 inches (400 mm) on center.

F. Place joint reinforcement in first and second horizontal joints above base pad and below lid frame opening.

3.05 SCHEDULES

A. Storm Sewer Manholes: Precast concrete sections, galvanized steel steps, 48 inch (1200 mm) inside dimension, to depth indicated, with bolted lid.

B. Electric Service Manholes: Prefabricated FRP sections, integral molded steps, 60 inch (1500 mm) inside dimension, to depth indicated.

END OF SECTION

PART 1 - GENERAL:

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 1, Specification Sections apply to work in this section.

1.02 DESCRIPTION OF WORK:

A. This section specifies materials, work and standards for site and utility construction materials and work.

1.03 RELATED WORK:

A. Refer to Section 31 20 00 "Earthmoving"; Section 33 41 00 "Storm Drainage", Division 22 "Plumbing" and Division 26 "Electrical".

1.04 STANDARDS:

A. Washington Suburban Sanitary Commission's (WSSC) current "General Conditions and Standard Specifications".

B. Maryland Department of Transportation State Highway Administration current “Standard Specifications for Construction and Materials”, Measurement and Payment Clauses do not apply.

C. American Concrete Institute (ACI).

1.05 SUBMITTALS:

A. Products:

1. Submit typewritten list of selected products, when options are specified, within ten (10) calendar days after contract execution. Submit detailed shop drawings of utility modifications required by selection of options.
2. Submit manufacturer's descriptive literature of structure castings.
3. Submit Portland cement concrete mix design formula for each class specified.
4. Submit certificates, signed by manufacturer or producer and contractor, stating the following comply with this specification:
    a. Portland cement.
    b. Fine aggregates.
    c. Coarse aggregates.
    d. Portland cement concrete.
    e. Concrete masonry units.
    f. Brick.
    g. Foundation materials.
    h. Bedding materials.
5. Submit shop drawings, of the following, indicating concrete reinforcement locations, size and placement:
    a. Cast in place reinforced concrete structures.
    b. Pre-cast reinforced concrete structures.
6. Submit location of product manufacture and of extraction/recovery of primary raw materials.

7. Submit recycled-content data, designating percentages of post-consumer and post- industrial recycled material.
8. Submit certification of FSC-certified sustainably harvested wood formwork materials, if applicable.

B. Compaction Equipment: Submit compaction equipment data prior to start of controlled fill earthwork operations.

C. Testing: Submit test reports of testing specified.

D. “As-Built” Plans: Submit “as-built” plans for water, sanitary sewer and storm drainage systems. Submit to the Owner’s Representative and to controlling utility agencies as required.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Delivery: Schedule delivery operations to avoid unnecessary re-handling.

B. Storage:

1. General: Store in accordance with manufacturer's recommendations and as noted.
2. Store on platforms above ground and protect from adverse environmental conditions.
3. Aggregates: Store to prevent foreign material contamination.
4. Utility Joint Materials and Lubricants: Store in cool and dry location free of oil, grease, excessive heat and direct sunrays.

C. Handling:

1. General: Comply with manufacturer's recommendations and as noted.
2. Aggregates: Handle to prevent segregation.
3. Pre-cast Concrete Structures: Handle to prevent damage. Utilize lifting holes provided by structure manufacturer.

1.07 DEFINITIONS:

A. Refer to Section 31 20 00 "Earthmoving".

1.08 PROJECT CONDITIONS:

A. Refer to Section 31 20 00 "Earthmoving" and as noted.

B. Traffic: Maintain pedestrian and vehicular traffic during utility construction operations.

C. Limitations:

1. Environmental: Do not place Portland cement products or erect masonry when ambient air temperature is below 40 degrees Fahrenheit or air temperature has been below 35 degrees Fahrenheit for twelve or more consecutive hours or between 15 November and 01 March without written authorization from the Owner’s Representative or the Architect.

D. Certifications, Inspections and As-Built Documents:

1. The Contractor shall provide inspection, certification and "as-built" plans of the on- site water, sanitary sewer service and storm sewer work by a registered professional Engineer. Contractor shall notify the Architect within 15 calendar days of signing the contract who the Maryland Registered P.E. will be and who will certify the as- built water and sewer plan. Show any changes and include ties for the location of valves, bends, manholes, fire hydrants, and laterals accompanied by the qualifying air test date and certification of compliance. See Division One “Project Record Documents” for format of “as-built” drawings.

2. All storm drain system work must be inspected by Prince George's County in accordance with agency permit requirements. Record of as-built conditions will be required.

1.09 QUALITY ASSURANCE

A. Comply with standards of Prince George's County and WSSC for potable water service piping, including materials, installation, testing, etc.

B. Piping materials shall bear label, stamp or other markings of specified testing agency as required.

C. Electrical Components, Devices and Accessories: Listed and labeled as deifined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS:

2.01 MATERIALS:

A. Provide products manufactured and of primary raw materials extracted/recovered within a 500-mile radius of the project site.

B. Portland Cement Concrete: SHA Section 902, Portland Cement Concrete and Related Products.

1. Water: Clean and free of oil, acid and injurious amounts of vegetable matter, alkalis and salts. River, stream or lake water is prohibited.

2. Forms: Wood, steel or as specified. Form materials to produce smooth surfaces, free of irregularities. Nonrented wood formwork shall be made of FSC-certified sustainably harvested wood materials.

C. Mixes:

1. Class "A" Concrete: SHA Mix No. 4, Table 902 A. 28-Day compressive strength 3500 P.S.I. Maximum 50% GGBF slag replacement for Portland cement, per MDOT-SHA Specification 902.06.05.

2. Class "B" Concrete: SHA Mix No. 2, Table 902 A. 28-Day compressive strength 3000 P.S.I. Maximum 50% GGBF slag replacement for Portland cement, per MDOT-SHA Specification 902.06.05.

D. Concrete Reinforcements:

1. Steel bars: ASTM A 615, Grade 60, deformed, designation as indicated or specified. Minimum 99% recycled-content, of which minimum 60% shall be post-consumer and the remainder may be post-industrial material.

2. Steel Wire Mesh: ASTM A 185 welded wire mesh, roll type, size as indicated or specified.

E. Brick:

1. ASTM C 55 Concrete Building Brick, type I, grade N, standard manufacture size.

2. Type B: ASTM C 32 Clay or Shale Brick, grade SS or as specified, solid, 2-1/4 by 3-3/4 by 8 inches.

F. Cement Mortar: SHA Section 902.05, Masonry Cement.

1. Water: As specified for Portland cement concrete.

G. Cast-in-Place Reinforced Concrete Structures:

1. Structure Bases: Class "B" Portland Cement Concrete.

2. Structure Walls and Top Slabs: Class "A" Portland Cement Concrete.

3. Concrete Reinforcement, Structural Steel, Structure Castings and Appurtenances: As indicated and specified.

H. Pre-Cast Reinforced Concrete Structures:

1. Square and Rectangular Structures: ASTM C 858.
2. Structural Design Loading: ASTM C 858, live load designation A-16.
3. Circular Structures: ASTM C 478.
4. Structure Joints: ASTM C 443.

I. Foundation Materials:

1. Type I: ASTM C 33 Coarse Aggregate, size No. 8 (3/8 inch to No. 8).
2. Type II: SHA Coarse Aggregate Size No. 57 stone (1 1/2 inch to No. 8).
3. Type III: Earth material free of debris, waste materials, frozen materials, vegetable matter, clay, rocks or stones exceeding 1 inch in any dimension. Obtain Type III material from on-site excavations or off-site borrow areas approved by the Soils Engineer.

J. Bedding Materials:

1. Type A: ASTM C 33 Fine Aggregate.
2. Type B: ASTM C 33 Coarse Aggregate, size No. 6 (1 inch to No. 4).
   a. Contractor’s Option: SHA Coarse Aggregate Size No. 57 stone (1 1/2 to # 8.)
   b. Recycled concrete RC-6 may, at Contractor’s discretion, be used for bedding in approved locations.
3. Type C: Earth material free of debris, waste materials, frozen materials, vegetable matter, clay and rocks or stones exceeding one inch in any direction.

K. Bedding Material Schedule:

1. Storm drainage system: Type B, or as per manufacturers recommendations.
2. Water Distribution System: W.S.S.C. Standards, or Type A.
3. Sanitary Sewer System: W.S.S.C. Standards, or Type B.
4. All other utilities: Type C.

L. Backfill Materials: As specified for Fill or Backfill, Section 31 20 00 "Earthmoving", and as noted.

1. Utility Trenches:
   a. Phase I: Earth material free of debris, waste materials, frozen materials, vegetable matter and rock or stones exceeding one inch in any dimension.
   b. Phase II: Earth material free of debris, waste material, frozen material, vegetable matter and rock or stones exceeding two inches in any dimension.
2. Utility Structures: Earth material free of debris, waste material, frozen material, vegetable matter and rock or stones exceeding two inches in any dimension. Obtain backfill material from the following: Excavated material approved by the Soils Engineer or the Owner's Representative.

PART 3 - EXECUTION:

3.01 PROTECTION AND RESTORATION:

A. Refer to Section 31 20 00 "Earthmoving" and as noted.

B. General: Provide support systems (e.g. sheeting, shoring, sheet piling, cribbing, etc.) at no increase to contract sum. Cut off timber when using timber support systems above top of utility to prevent utility displacement. Exercise care when using trench shields or boxes during shield movement to prevent utility

displacement.

3.02 EXISTING UTILITIES:

A. Refer to Section 31 20 00 "Earthmoving", and as noted. Contractor shall notify "Miss Utility" at least 48 hours prior to start of construction.

B. Provide test pits at all existing utility crossings prior to any system construction. Verify utility inverts for review by Architect or the Owner's Representative to determine potential conflicts prior to start of system construction.

3.03 DEWATERING:

A. Refer to Section 31 20 00 "Earthmoving".

3.04 EXCAVATION:

A. Refer to Section 31 20 00 "Earthmoving" and as noted.

B. Trench Excavation: Open cut method or as specified. Excavate materials encountered to subgrade elevations indicated or specified.

1. Trench width below top of utility not to exceed the following clearances on each side of utility:

Utility Exterior Width, Diameter or Span	Clearance
1 thru 30 in.	16 in.
31 and higher	24 in.

2. Excavate utility trenches to the following depths:

a. Circular storm drainage pipe: Six inches below bottom of pipe.

b. Water distribution pipe: W.S.S.C. Standards or four inches below bottom of pipe.

c. Sanitary sewer pipe: W.S.S.C. Standards or six inches below bottom of pipe.

d. All other utilities: Bottom of utility.

C. Structure Excavation:

1. Utility structure excavation to produce 12-inch clearance between exterior structure walls and excavation walls or support systems.

2. Extend excavation to the following:

a. Cast in place reinforced concrete structures: Six inches beyond structure base.

b. Pre-cast reinforced concrete structures: Six inches below bottom of pre-cast structure base.

c. Pre-cast reinforced concrete structure with cast in place concrete base: Bottom of structure base.

d. Masonry structures: Bottom of structure base.

3.05 OVER-EXCAVATION:

A. Refer to Section 31 20 00 "Earthmoving", except as noted.

B. Utility Trenches:

1. Correct over-excavation of water distribution, storm drainage and gravity flow sanitary sewer systems by backfilling over-excavated trenches with Type II foundation (Type B bedding) material and compacting.

2. Correct over-excavation of all other utilities by backfilling over-excavated trenches with Type III foundation (Type C bedding) material and compacting.

3. Place material in loose lifts not exceeding eight inches. Compact each lift to 98 percent maximum dry density. Density test method: ASTM D 698.

C. Structures: Correct utility structure over-excavation by backfilling over-excavation with Type II foundation (Type B bedding) material and compacting.

1. Place material in loose lifts not exceeding eight inches. Compact each lift to 98 percent maximum dry density. Density test method: ASTM D 698.

3.06 UNSUITABLE EARTH:

A. Refer to Section 31 20 00 "Earthmoving", except as noted.

B. Restore unsuitable earth excavation as specified for over-excavation.

3.07 EXCAVATED MATERIAL STORAGE:

A. Refer to Section 31 20 00 "Earthmoving" and as noted.

B. Stockpile select excavated materials required for backfill operations.

3.08 PORTLAND CEMENT CONCRETE CONSTRUCTION:

A. Mixing:

1. Ready-Mixed Concrete: ASTM C 94.

2. Project Site Batch Mixing: ACI 301, Chapter 7.

B. Formwork: ACI 301, Chapter 4.

C. Reinforcement: ACI 301, Chapter 5.

D. Joints and Embedded Items: ACI 301, Chapter 6.

E. Placement: ACI 301, Chapter 8.

F. Surface Defects: ACI 301, Chapter 9.

G. Finishes: ACI 301. Non-Exposed: Section 10.2.1. Exposed: Section 10.2.2.

H. Curing and Protection: ACI 301, Chapter 12.

I. Cold Weather Concreting: ACI 306R.

J. Hot Weather Concreting: ACI 305R.

3.09 STRUCTURES:

A. Cast in Place Reinforced Concrete Structures: Construct cast in place concrete structures as indicated and specified.

B. Pre-cast Reinforced Concrete Structures:

1. Pre-cast structure base: Place Type I foundation material, on excavation subgrade, to bottom of structure base and compact to 98 percent of maximum dry density by ASTM D 698. Install pre-cast structure base, on compacted foundation material, level to 1/8 inch in 5 feet. Clean and lubricate structure joints, immediately prior to installation, in accordance with manufacturer's recommendation. Install pre-cast reinforced structure sections, on structure base, plumb to 1/4 inch in 10 feet. Position structure sections on previously installed section and push joints tightly together. Position concrete top slabs on structure as indicated. Plug lifting holes with cement mortar. Install frames and covers to finished grade with bricks and cement mortar.

C. Masonry Structures:

1. Erect structure walls with masonry materials specified. Wet each masonry unit thoroughly before placement. Shove each unit into place in full bed of cement mortar. Horizontal and vertical joints not to exceed 1/2 inch.

2. Bond and Coursing: Brick Masonry - Common Bond.

3. Fill joints completely with cement mortar. Fit masonry units tightly around utilities projecting through structure walls. Space, set and bond structure appurtenances as indicated or specified during masonry erection. Point up interior structure joints and clean removing excess cement mortar. Parge exterior structure walls with 1/2 inch thick cement mortar and finish with smooth trowel. Masonry construction tolerances not to exceed 1/4 inch in 10 feet vertical from plumb.

3.10 BEDDING:

A. Storm drainage pipe: Place bedding material, on excavated trench subgrade to bottom of pipe and compact. Upon completion of pipe installation, place and compact bedding material to springline of pipe.

B. All Other Utilities: Bedding not required. Install utilities on excavated trench subgrade as indicated or specified.

3.11 BACKFILL:

A. Backfill utility trenches in two consecutive phases as follows:

1. Phase I - Backfill to 12-inch depth above top of utility. Place backfill material in loose lifts not exceeding eight inches. Compact each lift to 90 percent maximum dry density. Density test method: ASTM D 1557.

2. Phase II - Unpaved Areas: Place backfill material to grade in loose lifts not exceeding 8 inches. Compact each lift to 85 percent maximum dry density. Density test method: ASTM D 1557

3. Phase III - Paved Areas: Place backfill material to grade in loose lifts not exceeding eight inches. Compact each lift to 90 percent maximum dry density. Density test method: ASTM D 1557.

B. Backfill utility structures as follows: Place backfill material carefully and in loose lifts not exceeding 12 inches (paved areas - 8 inches) in depth. Compact each lift to 95 percent maximum dry density. Density test method: ASTM D 698. Do not backfill masonry structures until cement mortar parge attains initial set.

3.12 EXCAVATED MATERIAL DISPOSAL:

A. Refer to Section 31 20 00 "Earthmoving".

3.13 WASTE MANAGEMENT:

A. Recycle waste materials in accordance with Division 1 “Construction Waste Management” requirements.

END OF SECTION

PART 1 – GENERAL:

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 1, Specification Sections apply to work in this section.

1.02 DESCRIPTION OF WORK:

A. This section specifies materials and work required to construct water distribution system.

1.03 RELATED WORK:

A. Refer to Section 33 10 00 "Utility Standards".

1.04 STANDARDS:

A. Washington Suburban Sanitary Commission's (WSSC) current "General Conditions and Standard Specifications" and "Standard Details".

B. Washington Suburban Sanitary Commission's current "Regulations Governing the Installation of Plumbing and Sewer Cleaning in the Washington Suburban Sanitary District".

C. American Water Works Association (AWWA).

1.05 SUBMITTALS:

A. Refer to Section 33 10 00 "Utility Standards" and as noted.

B. Products: Submit product manufacturer's specifications and installation instructions and certificates of compliance signed by manufacturer and contractor stating that products comply with this specification to the Architect. Certificates of compliance must be notarized, signed by an officer of the Manufacturer, and shall include W.S.S.C. Contract Number or On-site number, job location, Contractor’s name, types, classes and strengths of pipe and fittings, and the Manufacturer’s name.

C. Submit As-built drawings to the Architect.

D. Service Connection Permit: Contractor shall submit to Architect all items required by WSSC to obtain a Service Connection Permit, including but not limited to: All required WSSC Bonds, Letter indicating Utility Contractor, and Certificate of Insurance. The Architect will obtain the Service Connection Permit once all these items are received.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Refer to Section 33 10 00 "Utility Standards", and as noted.

1.07 PROJECT CONDITIONS:

A. Refer to Section 33 10 00 "Utility Standards", and as noted.

B. Jurisdiction Standards: Site is located within WSSC jurisdiction. On-site fire hydrants shall be "Supervised Fire Hydrants".

C. All on-site construction and materials shall be in accordance with the latest edition of the W.S.S.C. General Conditions and Standard Specifications, Design Manual, Standard Details and Plumbing and Gasfitters Regulations.

1.08 CONSTRUCTION SURVEYS:

A. Provide survey equipment and qualified personnel for construction surveys. Provide combined horizontal and vertical alignment stakes for system construction. Horizontal stake interval to be 50 feet and at all appurtenances (e.g. fittings, valves, etc.). Provide construction cut sheet preparation as required.

1.09 QUALITY ASSURANCE

A. Perform Work in accordance with Prince Georges County and WSSC standards, codes and requirements.

B. Manufacturers shall be experienced in the design and manufacturing of materials specified herein for a minimum period of 5 years

C. All pipe, regardless of diameter, shall be supplied by a single manufacturer.

D. Contractor shall conduct visual inspection prior installation. Proceeding with work constitutes acceptance of existing conditions.

E. Provide manufacturer's name and pressure rating marked on piping and valves

F. Provide piping complete with all fittings, jointing materials, supports, joint restraint system, and necessary appurtenances for watertight, fully operational sewer lines.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. All materials shall be W.S.S.C. Standards and shall meet all W.S.S.C. requirements indicated.

B. Valve Boxes: Cast iron two-piece valve boxes, screw type box, bell base section, 5-1/4 inch shaft, round drop cover with "W" marking.

2.02 FIRE HYDRANTS:

A. WSSC Standard.

2.03 CONCRETE PADS:

A. Class 'A' Portland cement.

2.04 CONCRETE ANCHORS:

A. W.S.S.C. Standards indicated and specified. Class 'A' Portland cement concrete, Section 33 10 00 "Utility Standards".

2.05 STRAPS AND RODS:

A. Clamps, Straps and Washers: Steel, ASTM A 506.

B. Rods: Steel, ASTM A 575.

C. Rod Couplings: Malleable-Iron, ASTM A 197

D. Bolts: Steel, ASTM A 307

E. Cast-Iron Washers: Gray-iron, ASTM A 126

2.06 MISCELLANEOUS PRODUCTS:

A. Underground Identification Tape: Manufactured by Allen Systems, Houston, Texas.

1. Type: “Markline”.
2. Color: Precaution Blue.
3. Legend: Caution water line buried below.
4. Tape Width: Three inches.

B. Disinfection Products: W.S.S.C. standards indicated and specified. For continuous feed disinfection method, use Calcium Hypochlorite: AWWA B 300, granular form.

1. Contractor's Option: AWWA B 301 Liquid Chlorine.

2. Contractor's Option: AWWA B 303 Sodium Chloride.
3. Water: Potable.

PART 3 - EXECUTION:

3.01 PROTECTION AND RESTORATION:

A. Refer to Section 33 10 00 "Utility Standards".

3.02 DEWATERING, EXCAVATION, OVER-EXCAVATION AND UNSUITABLE EARTH:

A. Refer to Section 33 10 00 "Utility Standards".

3.03 PIPE:

A. General:

1. Install in accordance with pipe manufacturer's installation instructions, W.S.S.C. standards and requirements and as noted.
2. Inspect each pipe laying length, pipe joint materials and fittings for defects. Remove defective products from project site. Install pipe to horizontal and vertical alignment indicated. Place fittings at changes in horizontal and vertical alignment as indicated. Construct concrete anchors at each fitting as indicated. Place concrete to permit access to joints for inspection and maintenance. Apply liberal coat of coal tar pitch to exposed steel and hardware. Field cut pipe only where required to complete closures or to install fittings, valves or fire protection equipment. Cut pipe to smooth square end with equipment designed for cutting pipe.

B. Ductile Iron Pipe:

1. Install pipe in accordance with AWWA C 600 and as noted.
2. Install with bell ends facing in direction of laying operations. Begin installation of pipe, with vertical gradient exceeding 10 percent, at lowest elevation and proceed upgrade. Place identifying mark on pipe not provided with spigot depth mark. Clean interior and exterior surfaces of bell and spigot removing oil, grit, excess coating and foreign matter. Lubricate pipe ends and gasket in accordance with pipe manufacturer's instruction.

C. Ductile Iron Push-On Pipe: Position each laying length in previously installed pipe and push or pull joint tightly together with mechanical device designed for pipe jointing. Grind or file spigot end of field cut pipe to resemble manufactured spigot end. Place spigot identifying depth mark as specified. Pipe joint deflection not to exceed the limits specified in Table 2, AWWA C 655.

3.04 BURIED VALVES:

A. Install valves in accordance with valve manufacturer's installation instructions, and W.S.S.C. requirements.

3.05 FIRE HYDRANTS:

A. General: Install fire hydrants at locations indicated, in accordance with AWWA M17 "Installation, Operation and Maintenance of Fire Hydrants", manufacturer's installation instructions, and W.S.S.C. standards and requirements.

3.06 BACKFILL:

A. Refer to Section 33 10 00 "Utility Standards" and as noted.

B. Watermain’s 4-inches and larger must be inspected by the Architect prior to completion of backfill operations. Contractor shall provide a minimum of 48 hours notice to the Architect before completion of backfill operations.

C. Valve Box Installation: Install valve box for each buried gate valve during backfill operations. Install boxes to prevent shock or stress transmission to valves or pipe and center over valve operating nut plumb to 1/4 inch in five feet. Adjust box cover flush to finished grade.

D. Underground Identification Tape: Install tape during backfill operations. Tape shall be centered over pipe, located 24 inches below finished grade.

3.07 SYSTEM TESTING:

A. General: Provide materials, equipment (e.g. pumps, gauges, etc.) and labor required to test system. Do not conduct tests until concrete anchors cure and set seven calendar days. Provide a minimum of 48 hours notification of planned testing. Test observation by local governing water authority personnel. Test system in accordance with AWWA C 600 and as noted.

B. Hydrostatic Pressure Tests: Conduct hydrostatic pressure tests, upon completion of Phase I backfill operations. Fill systems or valved section of system with water. Expel air from pipe. Slowly apply test pressure. Test pressure to be per approved plan. Test duration to be two hours. Test pressure shall not vary more than +5 psi for the duration of the test. Examine all system joints. Correct defective products or improper system installation as directed by the local governing water authority personnel.

C. Hydrostatic Leakage Tests: Conduct hydrostatic leakage tests upon completion of Phase II backfill operations. Test procedure as specified for hydrostatic pressure tests, except as noted. Test duration 24 hours. Allowable leakage for ductile iron pipe is not to exceed the limits specified in Table 3, AWWA C 600. Correct system installation exceeding allowable leakage specified as directed by the local governing water authority personnel.

3.08 INSPECTION AND CERTIFICATION:

A. Retain the services of a Maryland-Registered Professional Engineer for inspection of system construction and certification that system complies with standards specified. In accordance with the requirements on the approved WSSC drawings, the inspecting engineer must be the engineer of record for the approved WSSC drawings.

3.09 SYSTEM DISINFECTION:

A. Disinfect system in accordance with AWWA C 651, W.S.S.C. standards specified, and as noted. Provide materials, equipment (e.g. pumps, etc.) and labor required to disinfect system.

B. Disinfection Method: Continuous feed.

1. Preliminary and final flushing velocity to be 2.5 fps. Solution concentration as specified. Maintain 50 MG/L available chlorine during 24-hour disinfection period. Bacteriologic test interval every six hours. Flushing and drainage locations where directed by the Owner's Representative.

3.10 DISINFECTION TESTING:

A. Conduct chlorine residual tests upon completion of final flushing operations. Repeat disinfection operation until satisfactory chlorine residual quality tests are obtained.

3.11 WATER BACTERIOLOGIC QUALITY TESTING:

A. Retain the services of an independent testing laboratory to conduct water bacteriologic quality testing.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe and fittings for site water lines including domestic water lines and fire water lines.

B. Valves, Fire hydrants and Domestic water hydrants.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete for thrust restraints.

B. Section 09 9113 - Exterior Painting.

C. Section 21 1100 - Facility Fire-Suppression Water-Service Piping.

D. Section 31 2316 - Excavation: Excavating of trenches.

E. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.

F. Section 31 2323 - Fill: Bedding and backfilling.

G. Section 33 0110.58 - Disinfection of Water Utility Piping Systems: Disinfection of site service utility water piping.

H. Section 33 0513 - Manholes and Structures.

1.03 REFERENCE STANDARDS

A. AASHTO HB - Standard Specifications for Highway Bridges 2002, with Errata (2005).

B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2016.

C. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250 2016.

D. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2012.

E. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2018.

F. ASME B18.2.2 - Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series) 2015.

G. ASME B18.5.2.1M - Metric Round Head Short Square Neck Bolts 2006 (Reaffirmed 2011).

H. ASME B18.5.2.2M - Metric Round Head Square Neck Bolts 1982 (Reaffirmed 2010).

I. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2018.

J. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2014 (Editorial 2017).

K. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts 2015.

L. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts (Metric) 2007 (Reapproved 2013).

M. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2016.

N. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120 2015, with Editorial Revision (2018).

O. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series) 2015.

P. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40 2017.

Q. ASTM D2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80 2015.

R. ASTM D2855 - Standard Practice for the Two-Step (Primer & Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets 2015.

S. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter 2015.

T. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals 1998 (Reapproved 2011).

U. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding 2011 (Amended 2012).

V. AWWA C104/A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings 2016.

W. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems 2010.

X. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings 2017.

Y. AWWA C115/A21.15 - Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges 2011.

Z. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast 2017.

AA. AWWA C200 - Steel Water Pipe, 6 In. (150 mm) and Larger 2017.

BB. AWWA C203 - Coal-Tar Protective Coatings and Linings for Steel Water Pipe 2015.

CC. AWWA C205 - Cement-Mortar Protective Lining and Coating for Steel Water Pipe, 4 in. (100 mm) and Larger - Shop Applied 2012.

DD. AWWA C206 - Field Welding of Steel Water Pipe 2017.

EE. AWWA C207 - Steel Pipe Flanges for Waterworks Service, Size 4 In. Through 144 In. (100 mm Through 3,600 mm) 2013.

FF. AWWA C208 - Dimensions for Fabricated Steel Water Pipe Fittings 2012.

GG. AWWA C209 - Cold-Applied Tape Coatings for Steel Water Pipe, Special Sections, Connections, and Fittings 2013.

HH. AWWA C210 - Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines 2015.

II. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service 2009.

JJ. AWWA C502 - Dry-Barrel Fire Hydrants 2014.

KK. AWWA C504 - Rubber-Seated Butterfly Valves 3 In. (75 mm) Through 72 In. (1,800 mm) 2010.

LL. AWWA C508 - Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS 2017.

MM. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service 2015.

NN. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances 2017.

OO. AWWA C602 - Cement-Mortar Lining of Water Pipelines in Place, 4 In. (100 mm) and Larger 2017.

PP. AWWA C606 - Grooved and Shouldered Joints 2015.

QQ. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution 2016.

RR. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm), for Water Service 2017.

SS. AWWA M11 - Steel Water Pipe - A Guide For Design and Installation 2016.

TT. UL 246 - Hydrants for Fire-Protection Service Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with Prince Georges County and WSSC standards, codes and requirements.

B. Manufacturers shall be experienced in the design and manufacturing of materials specified herein for a minimum period of 5 years

C. All pipe, regardless of diameter, shall be supplied by a single manufacturer.

D. Contractor shall conduct visual inspection prior installation. Proceeding with work constitutes acceptance of existing conditions.

E. Provide manufacturer's name and pressure rating marked on piping and valves

F. Provide piping complete with all fittings, jointing materials, supports, joint restraint system, and necessary appurtenances for watertight, fully operational sewer lines.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers with labeling in place.

PART 2 PRODUCTS

2.01 WATER PIPE

A. Steel Pipe: Welded or Seamless complying with AWWA C200.

1. Underground Pipe and Fittings: Cement-mortar lining and cement-mortar coating.
2. Aboveground Pipe and Fittings: Cement-mortar lining.
3. Fittings: AWWA C208.
    a. Construct of same material as pipe with standard tube turns or segmentally welded sections to accommodate the type of couplings or joints provided.
    b. Thickness Rating: Comply with not less than specified pipe thickness and calculated pipe pressure rating.

c. Mechanically or manually wrap, line, and coat all fittings with same protective materials and applications used for pipe.

4. Pipe manufacturer to calculate and determine wall thickness and fittings in the following manner:
   a. Calculate pipe wall thickness on the basis of an allowable fiber stress in the steel equal to 50 percent of the minimum yield strength of the steel used in the manufacture of the pipe.
5. Joints:
   a. Rubber Gasketed Bell and Spigot: Provide pipe manufacturer's standard design, meeting the requirements of AWWA C200.
   b. Welded: Provide electrodes complying with AWWA C206.
   c. Sleeve Type Mechanical Coupled:
      1) Designed to couple plain-end piping by compression of a ring gasket at each end of the adjoining pipe sections and provide for confinement and compression of gaskets.
      2) Coupling Assembly:
         (a) One steel middle ring, flared or beveled at each end, providing a gasket seat and two steel or malleable iron follower rings, providing for confinement and compression of the gaskets.
         (b) Provide middle ring and follower rings consisting of true, circular sections, free from irregularities, flat spots, and surface defects.
         (c) Two resilient and tapered rubber gaskets, designed for resistance to set after installation.
         (d) Bolts and nuts to draw the follower rings toward each other to compress the gaskets.
      3) Bolts: Track head conforming to ASTM A307 Grade A, with nuts conforming to ASTM A563 and ASTM A563M Grade A.
      4) Coupling Strength: Not less than adjoining pipeline.
   d. Grooved and Shouldered:
      1) Groove pipe ends by roll grooving or provide weld-on adapters with cut grooves.
      2) Groove dimensions by roll grooving as recommended by the coupling manufacturer.
      3) Dimensions of grooves cut in adapters to conform with AWWA C606.
      4) Comply with AWWA C606 for pipe ends.
      5) Joint dimensions to comply with AWWA C606 for rigid joints and as indicated for flexible joints.
   e. Flanged:
      1) Steel Flanges: AWWA C207, Class D.
      2) Bolts, Nuts, and Rubber Gaskets: AWWA C207.
      3) Asbestos gaskets not allowed.
   f. Insulating Joints:
      1) Provide flanged type with insulating gasket, bolt sleeves, and washers to prevent metal-to-metal contact with adjacent piping.
      2) Gaskets: Dielectric type, full face, as recommended in Appendix to AWWA C115/A21.15.

3) Bolts and Nuts: As recommended in Appendix to AWWA C115/A21.15.

6. Lining and Coating:
   a. Cement-Mortar Lining: AWWA C602 applied in-place.
   b. Cement-Mortar Coating: AWWA C205, factory applied.
   c. Coal-Tar Epoxy Coating, Shop Applied: Clean, prime, and topcoat piping with coal-tar epoxy coating system in accordance with AWWA C210.

B. Ductile Iron Pipe: AWWA C151:
   1. Fittings: Ductile iron, standard thickness.
   2. Joints: AWWA C111/A21.11, Styrene butadiene rubber (SBR) or vulcanized SBR gasket with rods.
   3. Jackets: AWWA C105/A21.5 polyethylene jacket.

C. Copper Tubing: ASTM B88, Type K, annealed:
   1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.
   2. Joints: Compression connection or AWS A5.8M/A5.8, BCuP silver braze.

D. PVC Pipe: ASTM D1785 Schedule 40.
   1. Fittings: ASTM D2466, PVC.
   2. Joints: ASTM D2855, solvent weld.

E. Polyethylene Pipe: ASTM D3035, for 45 psig pressure rating (ASTM D3035, for 315 kPa pressure rating):
   1. Fittings: AWWA C901, molded or fabricated.
   2. Joints: Compression.

F. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Water Service" in large letters.

2.02 VALVES

A. Valves: Manufacturer's name and pressure rating marked on valve body.

B. Gate Valves Up To 3 Inches (75 mm):
   1. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, compression ends, with control rod, post indicator, valve key, and extension box.

C. Gate Valves 3 Inches (75 mm) and Over:
   1. AWWA C509, iron body, bronze trim, non-rising stem with square nut, single wedge, resilient seat, flanged ends, control rod, post indicator, valve key, and extension box.

D. Ball Valves Up To 2 Inches (50 mm):
   1. Brass body, Teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, AWWA inlet end, compression outlet with electrical ground connector, with control rod, valve key, and extension box.

E. Swing Check Valves From 2 Inches to 24 Inches (50 mm to 600 mm):
   1. AWWA C508, iron body, bronze trim, 45 degree swing disc, renewable disc and seat, flanged ends.

F. Butterfly Valves From 2 Inches to 24 Inches (50 mm to 600 mm):
   1. AWWA C504, iron body, bronze disc, resilient replaceable seat, water or lug ends, ten position lever handle.

2.03 BEDDING AND COVER MATERIALS

A. Bedding: As specified in Section 31 2316.13.

B. Cover: As specified in Section 31 2316.13.

2.04 ACCESSORIES

A. Concrete for Thrust Restraints: Concrete type specified in Section 03 3000.

B. Backflow Preventer:

C. Meter:

D. Manhole and Cover: Refer to Section 33 0513.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building service connection and municipal utility water main size, location, and invert are as indicated.

3.02 PREPARATION

A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare pipe connections to equipment with flanges or unions.

3.03 TRENCHING

A. See the sections on excavation and fill for additional requirements.

B. Hand trim excavation for accurate placement of pipe to elevations indicated.

C. Form and place concrete for pipe thrust restraints at each change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide thrust restraint bearing on subsoil.

D. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.04 INSTALLATION - PIPE

A. Maintain separation of water main from sewer piping in accordance with National Standard Plumbing code.

B. Group piping with other site piping work whenever practical.

C. Install pipe to indicated elevation to within tolerance of 5/8 inches (20 mm).

D. Install ductile iron piping and fittings to AWWA C600.

E. Install grooved and shouldered pipe joints to AWWA C606.

F. Route pipe in straight line.

G. Install pipe to allow for expansion and contraction without stressing pipe or joints.

H. Install access fittings to permit disinfection of water system performed under Section 33 0110.58.

I. Slope water pipe and position drains at low points.

J. Install trace wire 6 inches (150 mm) above top of pipe; coordinate with Section 31 2316.13.

3.05 INSTALLATION - STEEL PIPE

A. Make and assemble rubber-gasketed, bell-and-spigot joints in accordance with manufacturer's recommendations.

B. Make welded joints in accordance with AWWA C206 and install in accordance with AWWA M11, Chapter 12, Transportation, Installation, and Testing.

C. Assemble sleeve-type mechanical coupling joints in accordance with manufacturer's recommendations.

D. Make flanged joints water-tight without undue strain on other material and equipment, using right-sized bolts, and parallel to adjoining flanges.

E. Make grooved joints with equipment designed and produced by the manufacturer of grooved joint couplings and assemble in accordance with the coupling manufacturer's recommendations.

F. Make shouldered type joints with the specified coupling, connect with shouldered ends, and assemble in accordance with the couplings manufacturer's recommendations.

G. Make insulating joints with specified materials and assemble for flanged joints with bolts, with full size insulating sleeves for bolt holes, and no metal-to-metal contact with dissimilar metals after assembly.

H. After installation, line piping in-place with cement mortar in accordance with AWWA C602.

I. Finish joints on piping with cement-mortar lining in accordance with AWWA C205.

J. Finish joints on piping with coating by cleaning, priming, coating, and wrapping with cold-applied tape coating in accordance with AWWA C209.

K. Maximum, allowable offsets for bell-and-spigot rubber-gasket joints, from a straight line or grade, as required by vertical curves, horizontal curves, or offsets, shall be five degrees or less in accordance with manufacturer's recommendations.

L. Form short-radius curves and closures with short pipe lengths or specified, fabricated specials.

3.06 INSTALLATION - VALVES AND HYDRANTS

A. Set valves on solid bearing.

B. Center and plumb valve box over valve. Set box cover flush with finished grade.

C. Set hydrants plumb; locate pumper nozzle perpendicular to and facing roadway.

D. Set hydrants to grade, with nozzles at least 20 inches (500 mm) above ground.

E. Locate control valve 4 inches (100 mm) away from hydrant.

F. Provide a drainage pit 36 inches (900 mm) square by 24 inches (600 mm) deep filled with 2 inches (50 mm) washed gravel. Encase elbow of hydrant in gravel to 6 inches (150 mm) above drain opening. Do not connect drain opening to sewer.

G. Paint hydrants in accordance with Section 33 1419.

3.07 SERVICE CONNECTIONS

A. Provide water service to utility company requirements with reduced pressure backflow preventer and water meter with bypass valves and sand strainer.

B. Provide sleeve in retaining wall for service main. Support with reinforced concrete bridge. Calk enlarged sleeve watertight.

C. Anchor service main to interior surface of foundation wall.

D. Provide 18 gage, 0.0478 inch (1.21 mm) galvanized sheet metal sleeve surrounding service main to 6 inches (150 mm) above floor and 6 feet (1,800 mm) minimum below grade. Size for 2 inches (50 mm) minimum of glass fiber insulation stuffing.

3.08 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01 4000.

B. Pressure test water piping as required by WSSC .

C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner .

END OF SECTION

PART 1 - GENERAL

1.01 GENERAL

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 through Division 16 Specification Sections, apply to the Work of this Section.

1.02 SCOPE

A. The work covered under this section shall include fire hydrant installation. Section includes, but not necessarily be limited to, furnishing and installing fire hydrants or relocating fire hydrants in accordance with the Contract Documents.

1.03 QUALITY ASSURANCE

A. Materials: The Engineer will inspect all materials before and after installation to ensure compliance with the Contract Documents.

B. Field Tests

1. Fire hydrants installed at the same time as a new water main shall be tested, after installation, by the Contractor along with the water main.

2. Fire hydrants installed on an existing water main will be visually inspected for leakage by the Engineer at the existing water main line pressure before the excavation is backfilled. The hydrant, valve, and connecting pipe shall be leak free under line pressure.

1.04 SUBMITTALS

A. Shop drawings shall be submitted as specified in the "General Provisions" for the fire hydrants furnished and shall include the following information: product description, parts list, valve and hose connection sizes, operating nut style, and direction of opening.

PART 2 - PRODUCTS

2.01 MATERIALS FURNISHED BY THE COUNTY

A. The County will not furnish any materials for fire hydrant installation or relocation.

B. Acceptable manufacturers include:

1. Kennedy Valve, Model K-81-A;

2. Mueller

3. Centurian

4. Waterous

5. U.S. Pipe.

2.02 FIRE HYDRANTS

A. Hydrant valve opening shall be a minimum of a 5-1/4-inch diameter main valve opening. Inlet connection shall be 6-inch mechanical joint with accessories (glands, plain rubber gaskets, bolts and nuts).

B. Hose connections shall consist of two 2 1/2-inch diameter hose connections and one 4 1/2-inch diameter steamer or pumper connection threaded as follows: the 2 1/2-inch nose nozzles and 4-1/2 inch steamer nozzle shall have National Standard Threads.

C. Operating nut shall be 5 sided, 1 5/16 inches from point to flat, and shall turn left (counterclockwise) to open.

D. Outer casing shall be one-piece cast iron, designed to permit its extension without Excavating.

E. Hydrant design shall be such that when the barrel is broken, it may be replaced without excavating or breaking adjacent pavement; that the entire barrel, including all working parts along with the main and waste valve seats, may be removed for inspection or repair without excavating or disturbing the ground; and that underground flanges with bolts and nuts are eliminated.

F. The main valve seal shall be compression type sealing against a bronze seat and the valve shall open against pressure.

G. Between elbow and top cap, the barrel shall be made in two parts connected by a swivel segment to permit facing the nozzles in any direction.

H. Bonnet shall be bolted to the standpipe and shall have cast on the top an arrow and the word "Open" indicating the direction for opening.

I. Bonnet construction shall utilize a one piece construction that isolates the stem's operating threads from the wet portion of the barrel. The internal portion of the bonnet shall be factory filled with grease to lubricate the operating threads. O-rings shall be provided where the stem penetrates the bonnet to prevent water from entering the grease cavity and to prevent exfiltration of the lubricant.

J. A self opening drain valve shall be provided.

2.03 OTHER REQUIREMENTS

A. Gravel or crushed stone for hydrant foundation shall meet the gradation requirements of ASTM-C33/#67.

B. Retainer glands or tie rods and appurtenances for fire hydrant restraint, and pipe caps and plugs for existing fire hydrant lead abandonment shall be specified by contractor with approval by PGCPS building services..

C. Portland cement concrete for hydrant and cap blocking shall be coordinated with PGCPS building services.

PART 3 - EXECUTION

3.01 GENERAL

A. Excavation, foundation preparation, backfill, and compaction shall be as specified in Division 2.

B. Construction methods shall be in accordance with Division 2.

3.02 FIRE HYDRANT INSTALLATION

A. Fire hydrants shall be installed and restrained in accordance with the Standard Details, at the locations shown, and to elevations directed by the Engineer. Hydrants shall be set within a gravel or crushed stone drainage well extending the full width of the trench.

B. Hydrant leads shall be laid level on a firm foundation to insure that the hydrant is set plumb. Backfill around the hydrant shall be compacted so as to obtain a density of a least 95% of maximum when measured in accordance with AASHTO T180, Method D.

C. Where hydrants are to be relocated, the Contractor shall ascertain whether or not the hydrant valve has been restrained before removing the hydrant to be relocated. The lead shall be capped and blocked so that service can be restored to the parent main pending the removal or plugging of the mainline tee.

D. The outside of all fire hydrants above finished grade on PGCPS property shall be painted red or approved color to match the logo of the school. Coordinate with PGCPS Building Services.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 1, Specification Sections apply to work in this section.

1.02 DESCRIPTION OF WORK:

A. This section specifies materials and work required to construct gravity flow sanitary sewer system.

1.03 RELATED WORK:

A. Refer to Section 31 20 00 "Earthmoving", Section 33 10 00 "Utility Standards", Section 33 41 00 "Storm Drainage", and Division 26 "Plumbing".

1.04 STANDARDS:

A. Refer to Section 33 10 00 "Utility Standards", and as noted.

B. Washington Suburban Sanitary Commission's (WSSC) current "General Conditions and

C. Standard Specifications" and "Standard Details".

D. Washington Suburban Sanitary Commission's current "Regulations Governing the Installation of Plumbing and Sewer Cleaning in the Washington Suburban Sanitary District".

1.05 SUBMITTALS:

A. Refer to Section 33 10 00 "Utility Standards" and as noted.

B. Products: Submit product manufacturer's specifications and installation instructions and certificates of compliance signed by manufacturer and contractor stating that products comply with this specification to the Architect. Certificates of compliance must be notarized, signed by an officer of the Manufacturer, and shall include W.S.S.C. Contract Number or On-site number, job location, Contractor’s name, types, classes and strengths of pipe and fittings, and the Manufacturer’s name.

C. Options: Submit typewritten list of selected products when options are specified within 10 calendar days after contract execution. Submit detailed shop drawings of system modifications required by selection of options.

D. Submit shop drawings of precast structures indicating concrete reinforcement location, size and placement.

E. Submit As-built drawings to the Architect.

F. Service Connection Permit: Contractor shall submit to Architect all items required by WSSC to obtain a Service Connection Permit including but not limited to: All required WSSC Bonds, Letter indicating Utility Contractor, and Certificate of Insurance. The Architect will obtain the Service Connection Permit once all these items are received.

1.06 PRODUCT, DELIVERY, STORAGE AND HANDLING:

A. Refer to Section 33 10 00 "Utility Standards".

1.07 PROJECT CONDITIONS:

A. Refer to Section 33 10 00 "Utility Standards" and as noted.

B. All on-site construction and materials shall be in accordance with the latest edition of the W.S.S.C. General Conditions and Standard Specifications, Design Manual, Standard Details and Plumbing and Gasfitters Regulations.

C. Existing Sanitary Sewer System: Provide, install, operate and maintain pumps and related equipment required to divert sewage (bypass pumping) during system construction. Extend pump discharge lines to existing sanitary sewer structures. Surface flow is prohibited.

D. Traffic: Maintain vehicular and pedestrian traffic during system construction.

1.08 CONSTRUCTION SURVEYS:

A. Provide survey equipment and qualified personnel for construction surveys. Provide combined horizontal and vertical alignment stakes for system construction. Horizontal stake interval to be 25 feet maximum and at all structures. Provide construction cut sheet preparation as required.

1.09 QUALITY ASSURANCE

A. Perform Work in accordance with Prince Georges County and WSSC standards, codes and requirements.

B. Manufacturers shall be experienced in the design and manufacturing of materials specified herein for a minimum period of 5 years

C. All pipe, regardless of diameter, shall be supplied by a single manufacturer.

D. Contractor shall conduct visual inspection prior installation. Proceeding with work constitutes acceptance of existing conditions.

E. Provide manufacturer's name and pressure rating marked on piping and valves

F. Provide piping complete with all fittings, jointing materials, supports, joint restraint system, and necessary appurtenances for watertight, fully operational sewer lines.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. All materials shall be W.S.S.C. Standards and shall meet all W.S.S.C. requirements indicated.

B. Polyvinyl Chloride (PVC) Pipe: W.S.S.C. Standards indicated. ASTM D 3034, SDR 35 PVC gravity sewer pipe, size as indicated, standard manufacture laying length.

1. Pipe Joints: ASTM D 3212 bell and spigot type, with flexible elastomeric gasket seals. Gaskets shall meet the requirements of ASTM F 477.

2. Fittings shall be as indicated and required.

C. Cleanouts: W.S.S.C. standards indicated.

1. Cleanouts For Use in Paved Walk Areas: Refer to Section 33 41 00 "Storm Drainage", and as noted.

   a. Expansion Joint: ASTM D 994, bituminous preformed joint filler, 1/2 inch thick.

2. Furnish the Owner with one cleanout wrench.

D. Structures: W.S.S.C. standards specified and indicated.

E. Foundation and Bedding Materials: Refer to Section 33 10 00 "Utility Standards". F. Concrete: Refer to Section 33 10 00 "Utility Standards".

F. Miscellaneous Products:

G. Underground identification type manufactured by Allen Systems, Houston, Texas. "Detectatape" type, three inches wide, marked "Caution Sewer Line Buried Below", "Safety Green" color.

PART 3 - EXECUTION

3.01 DEWATERING, EXCAVATION, OVER-EXCAVATION AND UNSUITABLE EARTH:

A. Refer to Section 33 10 00 "Utility Standards".

3.02 EXISTING SYSTEM CONNECTION:

A. Notify WSSC no less than 48 hours prior to the start of system construction.

B. Excavate and expose existing pipe at connection location indicated. Adjust connection location, as required, in the event of conflicts with existing pipe joints. Neatly cut existing pipe and prepare cut end as required for connection with new pipe. Make connections with existing pipe using fittings designed for the purpose, in accordance with manufacturer's installation instructions.

3.03 PIPE:

A. General: Install in accordance with manufacturer's installation instructions and as noted. Inspect each pipe laying length and pipe joint materials for defects. Remove defective products from project site. Install pipe to horizontal and vertical alignment indicated. Begin with installation at lowest system elevation and proceed up-grade. Field cut pipe only where required to complete structure-to-structure closures, install fittings or as specified. Cut pipe to smooth square end with equipment designed for cutting pipe.

B. Polyvinyl Chloride (PVC) Pipe: Install pipe in accordance with ASTM D 2321, manufacturer's installation instructions, and as noted.

1. Install with pipe spigot end pointing in flow direction. Begin installation of pipe, with vertical gradient exceeding 10 percent, at lowest elevation and proceed up- grade. Clean bell and spigot interior and exterior surfaces, removing oil, grit and foreign matter. Lubricate pipe ends and gasket in accordance with manufacturer's instructions. Position each laying length of previously installed pipe and manually push joint tightly together.

2. Field Pipe Cutting: Shape spigot end of cut pipe to resemble manufactured spigot end, with a pipe-beveling tool designed for PVC pipe. Copy the full insertion mark provided on the manufactured spigot end onto the prepared field cut end.

3.04 EXISTING PIPE/STRUCTURE CONSTRUCTION:

A. Excavate and expose existing pipe at structure location indicated. Adjust structure location as directed by the Architect or Owner's Representative in the event existing pipe joint interferes with structure walls, or as required to obtain required invert, at no increase to contract sum. Manually excavate below existing pipe prior to structure base placement. Place concrete structure base and construct structure as specified. Neatly cut and remove upper half of existing pipe and construct invert flow channel.

3.05 STRUCTURES:

A. Refer to Section 33 10 00 "Utility Standards" and as noted.

B. Pipe Connections: Install pipe opening sleeves in accordance with manufacturer's installation instructions. Neatly cut pipes flush with interior structure walls except as otherwise indicated or specified.

C. Structure Joints: Apply liberal coat of joint coating material to each structure section joint in accordance with manufacturer's application instructions.

D. Invert Flow Channels: Construct invert flow channels smooth and semicircular in shape. Shape channels with horizontal circular curve radii as large as structure will permit. Neatly form channels in structure base with bricks and cement mortar.

3.06 CLEANOUTS:

A. Refer to Section 33 41 00 "Storm Drainage", and as noted.

B. Install cleanouts in accordance with manufacturer's installation instructions and as indicated.

C. Construct concrete pads of Class "A" concrete as indicated.

D. Cleanouts in paved walk shall be installed without a concrete pad. Top shall be cast into and set flush with finished walk surface.

3.07 BACKFILL:

A. Refer to Section 33 10 00 "Utility Standards", and as noted.

B. Sanitary Sewer mains must be inspected by the Architect prior to completion of backfill operations. Contractor shall provide a minimum of 48 hours notice to the Architect before completion of backfill operations.

C. Underground Identification Tape: Install tape during backfill operations. Tape shall be centered over pipe, located 12 inches above top of pipe.

3.08 SYSTEM TESTING:

A. Provide equipment, materials and labor required to test system. Conduct low pressure air tests in accordance with local jurisdiction approving agency standards. Provide a minimum of 48 hours notification of planned testing. Test observation by W.S.S.C. personnel.

B. Repair or replace defective products and system construction, which fails tests as directed by local jurisdiction approving agency. Provide additional corrective work and retesting until system is approved and accepted. Provide corrective work and retesting at no increase to contract sum.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Building Perimeter, Retaining Wall and Under-Slab Drainage Systems.

B. Filter aggregate and fabric and bedding.

1.02 RELATED REQUIREMENTS

A. Section 31 2316 - Excavation: Excavating for subdrainage system piping and surrounding filter aggregate.

B. Section 31 2316.13 - Trenching: Excavating and backfilling for site subdrainage systems.

C. Section 31 2323 - Fill: Backfilling over filter aggregate, up to subgrade elevation.

1.03 REFERENCE STANDARDS

A. ASTM C4 - Standard Specification for Clay Drain Tile and Perforated Clay Drain Tile 2004 (Reapproved 2018).

B. ASTM C412 - Standard Specification for Concrete Drain Tile 2015.

C. ASTM C412M - Standard Specification for Concrete Drain Tile (Metric) 2015.

D. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings 2011.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pipe drainage products, pipe accessories.

C. Shop Drawings: Indicate dimensions, layout of piping, high and low points of pipe inverts, gradient of slope between corners and intersections.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Project Record Documents: Record location of pipe runs, connections, cleanouts and principal invert elevations.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with Prince Georges County and WSSC standards, codes and requirements.

B. Manufacturers shall be experienced in the design and manufacturing of materials specified herein for a minimum period of 5 years

PART 2 PRODUCTS

A. Contractor shall conduct visual inspection prior installation. Proceeding with work constitutes acceptance of existing conditions.

2.02 REGULATORY REQUIREMENTS

A. Conform to applicable code for materials and installation of the work of this section.

2.03 PIPE MATERIALS

A. Polyvinyl Chloride Pipe: ASTM D2729; plain end, 4 inch (100 mm) inside diameter; with required fittings.

B. Bituminous Fiber Pipe: With Type split collar or internal coupling joints; 4 inch (100 mm) inside diameter; with necessary fittings.

C. Clay Pipe: ASTM C4 Standard Class, 4 inch (100 mm) inside diameter, with required fittings.

D. Concrete Pipe: ASTM C412 (ASTM C412M) Standard-Quality, 4 inch (100 mm) inside diameter, with required fittings.

E. Corrugated Plastic Tubing: Flexible type; 4 inch (100 mm) diameter, with required fittings.

F. Use perforated pipe at subdrainage system; unperforated through sleeved walls.

2.04 AGGREGATE AND BEDDING

A. Filter Aggregate and Bedding Material: Granular fill as specified in Section 31 2323.

B. Filter Sand and Bedding Material: Sand as specified in Section 31 2323.

C. Impervious Fill Material: as specified in Section 31 2323.

2.05 ACCESSORIES

A. Pipe Couplings: Solid plastic.

B. Joint Covers: No. 15 asphalt saturated roofing felt.

C. Filter Fabric: Water pervious type, black polyolefin.

D. Sleeve: wall sleeve type for foundation wall.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.

3.02 PREPARATION

A. Hand trim excavations to required elevations. Correct over-excavation with fine grained fill.

B. Remove large stones or other hard matter that could damage drainage piping or impede consistent backfilling or compaction.

3.03 INSTALLATION

A. Install and join pipe and pipe fittings in accordance with pipe manufacturer's instructions.

B. Place drainage pipe on clean cut subsoil.

C. Lay pipe to slope gradients noted on drawings; with maximum variation from true slope of 1/8 inch (3 mm) in 10 feet (3 m).

D. Loosely butt pipe ends. Place joint cover strip 12 inches (300 mm) wide, around pipe diameter centered over joint.

E. Place pipe with perforations facing down. Mechanically join pipe ends.

F. Install pipe couplings.

G. Install filter aggregate at sides, over joint covers and top of pipe. Provide top cover compacted thickness of 12 inches (300 mm).

H. Place filter fabric over levelled top surface of aggregate cover prior to subsequent backfilling operations.

I. Place aggregate in maximum 4 inch (100 mm) lifts, consolidating each lift.

J. Refer to Section 31 2323 for compaction requirements. Do not displace or damage pipe when compacting.

K. Place impervious fill over drainage pipe aggregate cover and compact.

L. Connect to storm sewer system with unperforated pipe , through installed sleeves.

M. Coordinate the Work with connection to municipal sewer utility service, and trenching.

3.04 FIELD QUALITY CONTROL

A. Section 01 4000 - Quality Requirements: Field inspection and testing.

B. Request inspection prior to and immediately after placing aggregate cover over pipe.

C. Inspect interior of piping to determine whether line displacement or other damage has occured. Inspect after approximately 24 inches (610 mm) of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:
    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified by Engineer/WSSC.
4. Re-inspect and repeat procedure until results are satisfactory.

D. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to WSSC requirements.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours advance notice.
4. Submit separate report for each test.
5. Gravity-Flow Storm Drainage Piping: Test according to WSSC requirements.

E. Leaks and loss in pressure constitutes defects that must be repaired.

F. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.05 PROTECTION

A. Protect pipe and aggregate cover from damage or displacement until backfilling operation begins.

END OF SECTION

SECTION 33 7119
ELECTRICAL UNDERGROUND DUCTS, DUCTBANKS, AND MANHOLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Conduit and duct:
   1. Galvanized steel rigid metal conduit (RMC).
   2. Rigid polyvinyl chloride (PVC) conduit.
B. Precast concrete manholes.
C. Cast-in-place manhole accessories.
D. Accessories:
   1. Underground warning tape.

1.02 RELATED REQUIREMENTS

A. Section 03 1000 - Concrete Forming and Accessories.
B. Section 03 2000 - Concrete Reinforcing.
C. Section 03 3000 - Cast-in-Place Concrete.
D. Section 07 1113 - Bituminous Dampproofing.
E. Division 22 - Plumbing Specialties.
F. Section 22 1006 - Plumbing Piping Specialties.
G. Section 31 2316 - Excavation.
H. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.
I. Section 31 2323 - Fill: Bedding and backfilling.

1.03 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC) 2015.
B. ASTM A48/A48M - Standard Specification for Gray Iron Castings 2003 (Reapproved 2016).
C. ASTM C857 - Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures 2016.
D. ASTM C858 - Standard Specification for Underground Precast Concrete Utility Structures 2010.
E. ASTM C891 - Standard Practice for Installation of Underground Precast Concrete Utility Structures 2011.
F. ASTM C1037 - Standard Practice for Inspection of Underground Precast Concrete Utility Structures 2016.
G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.
H. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit 2013.
I. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing 2016.
J. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
K. UL 6 - Electrical Rigid Metal Conduit-Steel Current Edition, Including All Revisions.

L. UL 514B - Conduit, Tubing, and Cable Fittings Current Edition, Including All Revisions.

M. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings Current Edition, Including All Revisions.

1.04 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles (160 km) of Project.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 CONDUIT AND DUCT

A. Galvanized Steel Rigid Metal Conduit (RMC): NFPA 70, Type RMC; comply with ANSI C80.1 and list and label as complying with UL 6.

1. Fittings: Comply with NEMA FB 1 and list and label as complying with UL 514B; steel or malleable iron, threaded type.

B. Rigid Polyvinyl Chloride (PVC) Conduit: NFPA 70, Type PVC; comply with NEMA TC 2 and list and label as complying with UL 651; Schedule 40 unless otherwise indicated; rated for use with conductors rated 90 degrees C.

1. Fittings: Comply with NEMA TC 3 and list and label as complying with UL 651.

a. Manufacturer: Same as manufacturer of conduit to be connected.

2.02 PRECAST CONCRETE MANHOLES

A. Description: Precast manhole designed in accordance with ASTM C858, comprising modular, interlocking sections complete with accessories.

B. Loading: ASTM C857, Class A-16.

C. Shape: Square.

D. Base Section: Include 3 inch (75 mm) deep x 14 inch (350 mm) round sump with cast sleeve, and two 1 inch (25 mm) ground rod openings.

E. Top Section: Include 39 inch (1000 mm) diameter grooved opening for frame and cover.

F. Riser Casting: 6 inch (150 mm), with manhole step cast into frame.

G. Frames and Covers: ASTM A48/A48M; Class 30B gray cast iron, 27 inch (686 mm) size, machine finished with flat bearing surfaces. Provide cover marked ELECTRIC to indicate utility.

H. Duct Entry Provisions: Single duct knockouts.

I. Duct Entry Size: 4 inch (100 mm).

J. Cable Pulling Irons: Use galvanized rod and hardware. Locate opposite each duct entry. Provide watertight seal.

K. Cable Rack Inserts: Minimum load rating of 800 pounds (365 kg).

L. Cable Rack Mounting Channel: 1-1/2 x 3/4 inch (38 x 19 mm) steel channel, 48 inch (1.2 mm) length. Provide cable rack arm mounting slots on 1-1/2 inch (38 mm) centers.

M. Cable Racks: Steel channel, 1-1/2 x 3/4 x 14 inches (38 x 19 x 350 mm), with fastener to match mounting channel.

N. Cable Supports: Porcelain clamps and saddles.

O. Manhole Steps: Polypropylene plastic manhole step with 1/2-inch steel reinforcement (Polypropylene plastic manhole step with 13 mm steel reinforcement).

P. Sump Covers: ASTM A48/A48M; Class 30B gray cast iron.

2.03 CAST-IN-PLACE MANHOLE ACCESSORIES

A. Frames and Covers: ASTM A48/A48M; Class 30B gray cast iron, 27 inch (686 mm) size, machine finished with flat bearing surfaces. Provide cover marked ELECTRIC to indicate utility.

B. Cable Pulling Irons: Use galvanized rod and hardware.

C. Cable Rack Inserts: Minimum load rating of 800 pounds (365 kg).

D. Cable Rack Mounting Channel: 1-1/2 x 3/4 inch (38 x 19 mm) steel channel, 48 inch (1.2 mm) length. Provide cable rack arm mounting slots on 1-1/2 inch (38 mm) centers.

E. Cable Racks: Steel channel, 1-1/2 x 3/4 x 14 inches (38 x 19 x 350 mm), with fastener to match mounting channel.

F. Cable Supports: Porcelain clamps and saddles.

G. Manhole Steps: Polypropylene plastic manhole step with 1/2-inch (13 mm) steel reinforcement.

H. Sump Covers: ASTM A48/A48M; Class 30B gray cast iron.

2.04 ACCESSORIES

A. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for the conduit/duct arrangement to be installed.

B. Bore Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for installation within casing; furnished with roller wheels to facilitate installation, openings to facilitate grout flow, and holes for stabilization cable; suitable for the casing and conduit/duct arrangement to be installed.

C. Underground Warning Tape: Polyethylene tape suitable for direct burial.

1. Non-detectable Type Tape: 6 inches (152 mm) wide, with minimum thickness of 4 mil (0.1 mm).
2. Foil-backed Detectable Type Tape: 3 inches (76 mm) wide, with minimum thickness of 5 mil (0.1 mm), unless otherwise required for proper detection.
3. Legend: Type of service, continuously repeated over full length of tape.
4. Color:
    a. Tape for Buried Power Lines: Black text on red background.
    b. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.05 SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Precast Manholes: Inspect in accordance with ASTM C1037.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify routing and termination locations of duct bank prior to excavation for rough-in.

C. Verify locations of manholes prior to excavating for installation.

D. Duct bank routing is shown in approximate locations unless dimensions are indicated. Route as required to complete duct system.

E. Manhole locations are shown in approximate locations unless dimensions are indicated. Locate as required to complete ductbank system.

3.02 DUCT BANK INSTALLATION

A. Install duct to locate top of ductbank at depths as indicated on drawings.

B. Install duct with minimum slope of 4 inches per 100 feet (100 mm per 25.4 m) (0.33 percent). Slope duct away from building entrances.

C. Cut duct square using saw or pipe cutter; de-burr cut ends.

D. Insert duct to shoulder of fittings; fasten securely.

E. Join nonmetallic duct using adhesive as recommended by manufacturer.

F. Wipe nonmetallic duct dry and clean before joining. Apply full even coat of adhesive to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

G. Install no more than equivalent of three 90-degree bends between pull points.

H. Provide suitable fittings to accommodate expansion and deflection where required.

I. Stagger duct joints vertically in concrete encasement 6 inches (150 mm) minimum.

J. Use suitable separators and chairs installed not greater than 4 feet (1200 mm) on centers.

K. Band ducts together before backfilling.

L. Securely anchor duct to prevent movement during concrete placement.

M. Place concrete under provisions of Section 03 3000. Use mineral pigment to color concrete red.

N. Provide minimum 3 inch (75 mm) concrete cover at bottom, top, and sides of ductbank.

O. Provide two No. 4 steel reinforcing bars in top of bank under paved areas.

P. Provide suitable pull string in each empty duct except sleeves and nipples.

Q. Swab duct. Use suitable caps to protect installed duct against entrance of dirt and moisture.

R. Interface installation of underground warning tape with backfilling. Install tape 6 inches (150 mm) below finished surface.

3.03 PRE-CAST MANHOLE INSTALLATION

A. Install and seal precast sections in accordance with ASTM C891.

B. Install manholes plumb.

C. Use precast neck and shaft sections to bring manhole cover to finished elevation.

D. Attach cable racks to inserts after manhole installation is complete.

E. Install drains in manholes and connect to site drainage system under provisions of Division 22.

F. Dampproof exterior surfaces, joints, and interruptions of manholes after concrete has cured 28 days, under provisions of Section 07 1113.

G. Backfill manhole excavation under the provisions of Section 31 2323.

3.04 CAST-IN-PLACE MANHOLE INSTALLATION

A. Excavate for manhole installation under the provisions of Section 31 2316.

B. Formwork: Form inside and outside manhole surfaces in accordance with provisions of Section 03 1000.

C. Reinforcing: Install reinforcing under the provisions of Section 03 2000.

D. Concrete: Provide air-entrained, 2000 psi (20 MPa) compressive strength at 28 days under the provisions of Section 03 3000.

E. Shape: Square.

F. Base: Include 14 inch (350 mm) drain opening and two 1 inch (25 mm) ground rod openings. Slope to drain at 0.25 inch per foot (6.35 mm per m) (2 percent).

G. Top: Include 39 inch (1000 mm) diameter opening; cast 1/2 inch (13 mm) rod in opening to accept ladder hook.

H. Duct Entry: Cast duct openings in walls as indicated.

I. Cable Pulling Irons: Locate opposite each duct entry.

J. Construct brick collar with 30 inch (760 mm) clear opening to bring cover to proper elevation.

K. Manhole Steps: Cast steps at 12 inches (300 mm) on center vertically.

L. Install ladder in each manhole.

M. Attach cable racks to inserts after manhole construction is complete.

N. Install drains in manholes and connect to site drainage system under provisions of Division 22.

O. Install drains in manholes and connect to 4 inch pipe terminating in 0.33 cu yd (0.25 cu m) crushed gravel bed under provisions of Section 22 1006.

P. Dampproof exterior surfaces, joints, and interruptions of manholes after concrete has cured 28 days, under provisions of Section 07 1113.

Q. Backfill manhole excavation under the provisions of Section 31 2323.

END OF SECTION

Part 1 - General

I. REQUIREMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

II. SCOPE

A. The work covered under this Section shall include furnishing and installing an overhead electrical service complete as shown on the Drawings and herein specified.

III. QUALITY ASSURANCE

A. All equipment, materials and their installation shall conform to the requirements of the National Electrical Code (NEC), local code requirements, and these Specifications.

B. All equipment and material shall be listed by Underwriter's Laboratories, Inc. (UL) for their intended use and shall bear the UL label.

C. Equipment shall be constructed in accordance with National Electrical Manufacturer's Association (NEMA) standards.

D. All electrical work specified under this Section of these Specifications shall conform to the requirements of the electrical utility company.

E. The grounding systems shall comply with the NEC and as hereinafter specified.

Part 2 - Products

I. ELECTRICAL SERVICE

A. Primary service shall be three-phase with pole mounted transformer and shall be furnished by Potomac Electric Power Company in most instances and Baltimore Gas and Electric or Southern Maryland Electric Cooperative in selected instances.

B. This Contractor shall furnish and install secondary overhead service into the building and extend to metering equipment as shown on the Drawings. Secondary voltage, phase, and number of wires shall be as shown on the Drawings.

C. All necessary devices, such as meter sockets, meter connection boxes, meter enclosures, current and/or potential transformers, instrument transformer hangers, and cabinets shall be furnished to this Contractor by the electric utility company.

II. MATERIALS AND COMPONENTS

A. Materials shall be furnished and installed by this Contractor as shown on the Drawings and as herein specified.

B. All components exposed to the weather shall be UL listed for the application and conditions.

Part 3 - Execution

I. SERVICE INSTALLATION

A. This Contractor shall furnish and install a metering system as shown on the Drawings and as required by the electric utility company serving the project.

B. This Contractor shall make all necessary final agreements with the electric utility company for the installation of the permanent overhead electrical service.

END OF SECTION

SECTION 00 0110
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END OF SECTION

SECTION 01100 - SUMMARY

PART 1 GENERAL

1.1 PROJECT

A. Project Name:

B. Owner's Name: Prince Georges County Public School.

C. Architect's Name:

1.2 CONTRACT DESCRIPTION

A. Contract Type:

1.3 DESCRIPTION OF ALTERATIONS WORK

A. Scope of demolition and removal work is shown on drawings and specified in Section 02 4100.

B. Scope of alterations work is shown on drawings.

C. Owner will remove the following items before start of work:
   1. Non-fixed furnishings.
   2. Computers, document cameras, projectors.

1.4 WORK BY OWNER

A. Items noted NIC (Not in Contract) will be supplied and installed by Owner before Substantial Completion. Some items include:
   1. Movable cabinets.
   2. Furnishings.
   3. Small equipment.

1.5 OWNER OCCUPANCY

A. Owner intends to occupy the Project upon Substantial Completion.

B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

C. Schedule the Work to accommodate Owner occupancy.

1.6 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.

B. Arrange use of site and premises to allow:
   1. Work by Others.
   2. Work by Owner.

C. Provide access to and from site as required by law and by Owner:

1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
2. Do not obstruct roadways, sidewalks, or other public ways without permit.

D. Time Restrictions:
   1. Limit conduct of especially noisy exterior work to the hours of 7:00 AM - 7:00PM.

END OF SECTION

SECTION 01310 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. Requests for Information (RFIs).
4. Project meetings.

B. Related Requirements:

1. Section 01320 “Construction Progress Documentation” for preparing and submitting Contractor's construction schedule.
2. Section 01400 “Quality Requirements” for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Section 01700 “Execution and Closeout Requirements” for coordinating closeout of the Contract.

1.3 DEFINITIONS

A. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.5 ABOVE-CEILING PRE-CONSTRUCTION CONFERENCE AND COORDINATION DRAWINGS

A. Coordination Drawings (Optional): Prior to the Above-Ceiling Pre-Construction Conference, prepare drawings where limited space availability necessitates maximum utilization of space for the proper and efficient installation of the components, materials, and systems (including, but may not be limited to: above finish ceilings; within chases and shafts; and within mechanical and electrical spaces).

1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:
   a. Ensure components, materials, and systems are indicated where each are fully functional, operational, accessible, and complete.
   b. Indicate relationships of components, materials, and systems with surrounding construction.
   c. Indicate installation sequences to avoid conflicts
   d. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
2. Sheet Size: At least 8-1/2 by 11 inches but no larger than 30 by 42 inches.
3. Number of Copies: Submit two opaque copies. Architect will return one copy.
   a. Coordination Drawings will not be approved by the Architect and will be considered as "information only" and will be furnished to the Owner for filing.
   b. Submit five copies where Coordination Drawings are required for operation and maintenance manuals. Architect will retain two copies; remainder will be returned. Mark up and retain one returned copy as a Project Record Drawing.
4. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.

B. Above-Ceiling Pre-Construction Conference: Schedule and conduct with all affected parties present to review procedures for addressing potential conflicts, review of Coordination Drawings (if furnished) and obtain approval of each affected trade to ensure components, materials, and systems can be installed as intended prior to the Work being performed.

1. Identify Above-Ceiling Pre-Construction Conference on the Construction Schedule as a "milestone" date.
2. Advise the Architect of potential conflicts identified in the Coordination Drawings (if furnished) and Above-Ceiling Pre-Construction Conference.
3. Do not proceed with construction or installation of the components, materials, and systems until potential conflicts identified have been resolved and affected parties have agreed to a remedy.

C. Remedies to address conflicts not identified in the Coordination Drawings (if furnished), Above-Ceiling Pre-Construction Conference, or otherwise addressed prior to construction or installation of the affected components, materials, and systems; or discovery of a non-workable situation without Coordination Drawings on file with the Owner will not be considered as a basis of delay, time extension, or additional cost to the Contract.

1.6 REQUESTS FOR INFORMATION (RFIs) General: Immediately on discovery of the need for additional information or interpretation of Contract Documents, Contractor shall prepare and

submit an RFI in the form specified.

1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Architect.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:
    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for approval of Contractor's means and methods.
    d. Requests for coordination information already indicated in the Contract Documents.
    e. Requests for adjustments in the Contract Time or the Contract Sum.
    f. Requests for interpretation of Architect's actions on submittals.
    g. Incomplete RFIs or inaccurately prepared RFIs.
2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to conditions of the Contract.
    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.

D. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log at intervals as established Software log with not less than the following:

1. Project name.
2. Name and address of Contractor.

3. Name and address of Architect.
4. RFI number including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.

E. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.

1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

1.7 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: The Contractor will prepare the meeting agenda and distribute it to all invited attendees.
3. Minutes: The Contractor will record significant discussions and agreements achieved. Within 7 days of the meeting the Contractor will distribute the meeting minutes to the Owner, the Architect's consultants, and to the Architect.
4. Additional comments and/or discrepancies must be recorded within 7 days of distribution. After 7 days, the meeting minutes will become the final record of each meeting.

B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement. Hold the conference at Project site or another convenient location. The Contractor shall conduct the meeting to review responsibilities and personnel assignments.

1. Conduct the conference to review responsibilities and personnel assignments.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect progress, including the following:
    a. Tentative construction schedule.
    b. Phasing.
    c. Critical work sequencing and long-lead items.
    d. Designation of key personnel and their duties.
    e. Lines of communications.
    f. Procedures for processing field decisions and Change Orders.
    g. Procedures for RFIs.
    h. Procedures for testing and inspecting.
    i. Procedures for processing Applications for Payment.
    j. Distribution of the Contract Documents.
    k. Submittal procedures.
    l. Coordination and submittal of color & finish related selections.
    m. Preparation of record documents.
    n. Use of the premises [and existing building].
    o. Work restrictions.
    p. Working hours.
    q. Owner's occupancy requirements.
    r. Responsibility for temporary facilities and controls.

s. Procedures for moisture and mold control.
t. Procedures for disruptions and shutdowns.
u. Construction waste management and recycling.
v. Parking availability.
w. Office, work, and storage areas.
x. Equipment deliveries and priorities.
y. First aid.
z. Security.
aa. Progress cleaning.

C. LEED Orientation and Q&A Sessions:

1. Schedule: Schedule a LEED Orientation session at the Project site or other convenient location no later than fifteen (15) days after execution of the Agreement and prior to commencement of construction activities. Conduct the meeting to review responsibilities and personnel assignments. This session may be included in the pre-construction conference if time permits.
2. Attendees: The Owner, Architect, Architect's LEED Coordinator, Civil Engineer, Mechanical/Electrical/Plumbing Engineer, the Contractor and its superintendent, major subcontractors, manufacturers, suppliers and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the Work.
3. Agenda to include:
   a. Overview of the LEED Green Building Rating System
   b. Contractor's LEED responsibilities
   c. Construction Waste Management
   d. Construction Indoor Air Quality Management
   e. LEED progress and final reporting
   f. Question and answer session

D. Pre-installation Conferences: Conduct a pre-installation conference at Project site before each construction activity that requires coordination with other construction. Contractor conducts conferences, records and distributes meeting minutes.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
   a. Contract Documents.
   b. Options.
   c. Related RFIs.
   d. Related Change Orders.
   e. Purchases.
   f. Deliveries.
   g. Submittals.
   h. Review of mockups.
   i. Possible conflicts.
   j. Compatibility requirements.
   k. Time schedules.
   l. Weather limitations.
   m. Manufacturer's written instructions.
   n. Warranty requirements.
   o. Compatibility of materials.
   p. Acceptability of substrates.
   q. Temporary facilities and controls.
   r. Space and access limitations.

s. Regulations of authorities having jurisdiction.
t. Testing and inspecting requirements.
u. Installation procedures.
v. Coordination with other work.
w. Required performance results.
x. Protection of adjacent work.
y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

E. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
   a. Preparation of record documents.
   b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
   c. Submittal of written warranties.
   d. Requirements for preparing operations and maintenance data.
   e. Requirements for delivery of material samples, attic stock, and spare parts.
   f. Requirements for demonstration and training.
   g. Preparation of Contractor's punch list.
   h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
   i. Submittal procedures.
   j. Coordination of separate contracts.
   k. Owner's partial occupancy requirements.
   l. Installation of Owner's furniture, fixtures, and equipment.
   m. Responsibility for removing temporary facilities and controls.
4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

F. Progress Meetings: The Contractor shall conduct progress meetings at biweekly intervals. Coordinate dates of meetings with preparation of payment requests.

1. Attendees: Representatives of the Owner, the Architect and the Contractor shall be represented at each of these meetings. Design consultants, Subcontractors, suppliers, and other entities concerned with current progress or involved in planning, coordination, or performance of future activities may be invited to attend these meetings on an as needed basis to resolve specific issues. All participants at these meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.
8) Temporary facilities and controls.
9) Progress cleaning.
   a) Progress of Construction Waste Management
   b) Progress of Indoor Air Quality Management
10) Quality and work standards.
11) Status of correction of deficient items.
12) Field observations.
13) Status of RFIs.
14) Status of proposal requests.
15) Pending changes. (Potential Change Order – PCO)
16) Status of Change Orders. (CO)
17) Pending claims and disputes.
18) Documentation of information for payment requests.

3. Minutes: Contractor will record and distribute meeting minutes, as noted. Additional comments and/or discrepancies must be recorded within 7 days of distribution. After 7 days, the meeting minutes will become the final record of each meeting.

4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.

a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01310

SECTION 01351 - LEED CERTIFICATION PROCEDURES

PART 1 GENERAL

1.1 PROJECT GOALS

A. Projects are to be designed to achieve as a minimum the LEED Silver rating as defined in the LEED(r) Green Building Rating System(tm) for Schools, 2009 Edition. Review specific project LEED rating goal with PGCPS before design proceeds.

B. Contractor is not responsible for the application neither for LEED certification, nor for determination of methods of achieving LEED credits unless specifically so indicated.

C. Many of the LEED credits can be achieved only through intelligent design of the project and are beyond the control of the Contractor. However, certain credits relate to the products and procedures used for construction. Therefore, the full cooperation of the Contractor and subcontractors is essential to achieving final certification.

D. Contractor shall familiarize himself with the relevant requirements and provide the necessary information and instruction to all subcontractors and installers.

E. Since Contractor and subcontractors may not be familiar with LEED requirements, this section includes a summary of the products and procedures intended to achieve LEED credits.
   1. Some credits are marked PREREQUISITE; these must be achieved regardless of the level of certification; many are dependent on proper performance by Contractor and subcontractors.
   2. Other credits involve quantifying percentages by weight and cost; these require careful recordkeeping and reporting by the Contractor.
   3. See www.usgbc.org for more information.

1.2 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for additional submittal procedures.

B. LEED Submittal/Report: For each product with the notation "show quantity on LEED submittal or report," submit a report with the following information:
   1. Submit with each Application for Payment; update the Report each period with latest period shown separately:
   2. Identify each product with:
      a. Name and manufacturer.
      b. Specification section number.
      c. Applicable Credit(s).
      d. Net weight per unit.
      e. Quantity installed.
      f. Material cost per unit.
      g. Total material cost.
   3. Attach evidence of compliance from either the manufacturer or an independent agency.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

END OF SECTION

SECTION 01351.6 - LEED SUBMITTAL FORMS

.1 PURPOSE

A. These forms are for the Contractor's use in submitting documentation to be used to determine whether particular credits have been achieved. The cooperation of subcontractors, suppliers, and manufacturers is required.

B. These forms apply to the following LEED Credits:
   1. MR Credits 3.1 and 3.2 - Materials Reuse.
   2. MR Credits 4.1 and 4.2 - Recycled Content.
   3. MR Credits 5.1 and 5.2 - Regional Materials.
   4. MR Credit 6 - Rapidly Renewable Materials.
   5. MR Credit 7 - Certified Wood.

.2 FORMS

A. 01351.601 - LEED Material Cost Summary Form: Certification by Contractor.

B. 01351.602- LEED Wood-Containing Product List: Certification by Contractor.

C. 01351.603 - LEED Metal-Containing Product List: Certification by Contractor.

D. 01351.604 - LEED New Product Content Form: Including separate reporting of wood, steel, rapidly renewable, and recycled content; data certification by manufacturer of product; cost and quantity certification by Contractor.

E. 01351.605 - LEED New Product Source Form: Data certification by manufacturer of product; cost and quantity certification by Contractor.

F. 01351.606 - LEED Reused Product Form: Data certification by manufacturer of product; cost and quantity certification by Contractor.

.3 PROCEDURES

A. All LEED submittal forms are to be submitted by Contractor; certifications are to be made by indicated party.

B. Where a LEED Submittal is called for, fill out and submit the appropriate form.
   1. Fill out one form for each different brand name product and each different manufacturer of a lot of commodity products.
   2. Where required attachments are specified, attach the documentation to the back of the form.

C. Each form must be signed by the entity capable of certifying the information.
   1. Certification signatures must be made by an officer of the company.
   2. For products, certification must be made by the manufacturer not the supplier.
   3. For custom fabricated products, certification by the fabricator is acceptable.

D. Submit the completed forms in accordance with the requirements of Section 01300 - Administrative Requirements, as information submittals.
   1. Give each form a unique submittal number.
   2. Do not combine LEED forms with product data or shop drawing submittals.

END OF SECTION

SECTION 01351.601 - LEED MATERIAL COST SUMMARY FORM

LEED SUBMITTAL FORM

1.1 IDENTIFICATION:

A. Project Name: _____

B. Project No.: _____

C. Architect: _____

1.2 THIS FORM APPLIES TO THE FOLLOWING LEED CREDITS:

A. MR Credits 3 - Materials Reuse.

B. MR Credits 4.1 and 4.2 - Recycled Content.

C. MR Credits 5.1 and 5.2 - Regional Materials.

D. MR Credit 6 - Rapidly Renewable Materials.

E. MR Credit 6 - Certified Wood.

1.3 PROCEDURE:

A. Because the above listed credits require computations based on the material costs for the project, the Contractor is required to submit the following cost breakdown, in addition to any cost breakdown specified elsewhere.

B. Costs are to be material costs excluding labor, overhead, and profit, but including delivery, storage, and handling charges. Revise cost summary whenever materials actually installed change due to contract modifications or Contractor preference.

1.4 CERTIFICATION

A. $_____Total Cost of All Materials

B. $_____Total Cost of Plumbing, HVAC, Electrical, and Communications

C. $_____Total Cost of Architectural Equipment in Divisions 11 Through 14

D. $_____Total Cost of Wood and Wood-Based Materials, including temporary construction items that will neither be incorporated into the work nor returned to their supplier for re-use.

1.5 CERTIFIED BY: (CONTRACTOR)

A. Print Name: _____

B. Signature: _____

C. Title: _____(officer of company), Date: _____

END OF SECTION

SECTION 01351.602 - LEED WOOD-CONTAINING PRODUCT LIST

LEED SUBMITTAL FORM

1.1 IDENTIFICATION:

A. Project Name: _____

B. Project No.: _____

C. Architect: _____

1.2 THIS FORM APPLIES TO LEED MR CREDIT 6 (CERTIFIED WOOD).

1.3 WOOD-CONTAINING PRODUCTS

A. Wood-containing products are those made of solid wood, wood chip, or wood fiber, or containing components made of solid wood, wood chip, or wood fiber.

B. Rationale: Because the computation for this credit is based on the total material costs for all wood and wood-based products on the project, the Contractor is required to submit the following itemization of wood and wood-based products, including materials used during construction but not incorporated into the finished work.

C. Procedure: For each wood-containing product provided for this project, submit "LEED New Product Content Form". At minimum, submit for the following products. Initial those for which the material content form is attached.

D. Permanent Wood-Containing Product List:
1. ____Wood framing, furring, and supports
2. ____Blocking, curbing, and nailers
3. ____Paneling
4. ____Architectural woodwork
5. ____Cabinets and casework
6. ____Doors and frames, including composite construction
7. ____Wood wall covering

E. Temporary Wood-Containing Product List:
1. ____Excavation supports
2. ____Concrete formwork and formwork supports
3. ____Bracing and shoring
4. ____Barricades and enclosures

1.4 CERTIFICATION

A. ____All other wood-containing products used on this project are shown on the attached list.

B. ____I certify that there are no other wood-containing products used on this project that exceed 1 percent of total material cost.

C. ____I certify that there are no other temporary facilities or construction using wood-containing products that exceed 1 percent of the total material cost.

D. CERTIFIED BY: (Contractor)

1. Print Name: _____
2. Signature: _____
3. Title: _____(officer of company), Date: _____

END OF SECTION

SECTION 01200 - PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

B. Documentation of changes in Contract Sum and Contract Time.

C. Change procedures.

D. Procedures for preparation and submittal of application for final payment.

1.2 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.

B. Correlate line items in the schedule of values with other required administrative forms and schedules, including the following:
   1. Application for Payment forms with continuation sheets.
   2. Submittal schedule.
   3. Items required to be indicated as separate activities in Contractor's construction schedule.

C. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
   1. Identification: Include the following Project identification on the schedule of values:
      a. Project name and location.
      b. Name of Architect.
      c. Architect's project number.
      d. Contractor's name and address.
      e. Date of submittal.
   2. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
      a. Related Specification Section or Division.
      b. Description of the Work.
      c. Name of subcontractor.
      d. Name of manufacturer or fabricator.
      e. Name of supplier.
      f. Change Orders (numbers) that affect value.
      g. Dollar value of the following, as a percentage of the Contract Sum to nearest one- hundredth percent, adjusted to total 100 percent.
         1) Labor.
         2) Materials.
         3) Equipment.
   3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of Contract Sum or as appropriate.
   4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
   5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.

6. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
8. Each item in the schedule of values and applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
   a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
9. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

D. Forms filled out by hand will not be accepted.

E. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.

F. Include in each line item, the amount of Allowances specified in this section. For unit cost Allowances, identify quantities taken from Contract Documents multiplied by the unit cost to achieve the total for the item.

G. Include separately from each line item, a direct proportional amount of Contractor's overhead and profit.

H. Revise schedule to list approved Change Orders, with each Application For Payment.

I. Correlate line items in the schedule of values with other required administrative forms and schedules, including the following:
   1. Application for Payment forms with continuation sheets.
   2. Submittal schedule.
   3. Items required to be indicated as separate activities in Contractor's construction schedule.

1.3 APPLICATIONS FOR PROGRESS PAYMENTS

A. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
   1. List of subcontractors.
   2. Schedule of values.
   3. Contractor's construction schedule (preliminary if not final).
   4. Products list (preliminary if not final).
   5. Schedule of lump sum and unit price allowances.
   6. Submittal schedule (preliminary if not final).
   7. List of Contractor's staff assignments.
   8. List of Contractor's principal consultants.
   9. Copies of building permits.
   10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
   11. Initial progress report.
   12. Report of preconstruction conference.
   13. Certificates of insurance and insurance policies.

14. Performance and payment bonds.
15. Data needed to acquire Owner's insurance.

B. All applications for payment are required to be submitted on the IAC/PSCP Form 306.4. The IAC/PSCP Form 306.4 can be downloaded at: http://www.pscp.state.md.us/forms/apgindex.cfm

C. Payment Period: Pencil copies of the payment applications are due by the 20th of the payment period. Final drafts of the payment application are due by the 1st of the payment period.

D. Payment Terms: As outlined per the Contract Agreement.

E. Payment Submission Requirements: Submit 6 original executed and notarized copies per payment application for processing. Scanned copies will be rejected for processing.

F. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.

G. Forms filled out by hand will not be accepted.

H. For each item, provide a column for listing each of the following:
1. Item Number.
2. Description of work.
3. Scheduled Values.
4. Previous Applications.
5. Work in Place and Stored Materials under this Application.
6. Authorized Change Orders.
7. Total Completed and Stored to Date of Application.
8. Percentage of Completion.
9. Balance to Finish.
10. Retainage.

I. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

J. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices.
    a. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:
    a. Materials previously stored and included in previous Applications for Payment.

b. Work completed for this Application utilizing previously stored materials.
c. Additional materials stored with this Application.
d. Total materials remaining stored, including materials with this Application.

K. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.

L. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of Work.

M. Include in Application for Payment LEED Material and Resource and Indoor Air Quality Progress Reports: Prepare the following LEED Credit template forms made available at preconstruction conference of LEED issues. Submit updated forms with each Application for Payment.
1. MR Credit 2: Construction Waste Management
2. MR Credit 4: Recycled Content
3. MR Credit 5: Regional Materials
4. MR Credit 7: Certified Wood
5. EQ Credit 4: Low-Emitting Materials

N. Transmittal: Submit six (6) signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. Each copy shall include waivers of lien and similar attachments as required.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
2. Include the following with the application:
a. Transmittal letter as specified for Submittals in Section 01 3000.
b. Construction progress schedule, revised and current as specified in 01 3000.
c. Current construction photographs specified in Section 01 3000

O. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.4 MODIFICATION PROCEDURES

A. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor.

B. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
2. Promptly execute the change.

C. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change. Contractor shall prepare and submit a fixed price quotation within 14 days.

D. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the Work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation. Document any requested substitutions in accordance with Section 01 6000.

E. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
   1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
   2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
   3. For pre-determined unit prices and quantities, the amount will based on the fixed unit prices.

F. Substantiation of Costs: Provide full information required for evaluation of each submitted Change Order
   1. Support each claim with the following required data:
      a. Quantities of products, labor, and equipment.
      b. Taxes, insurance, and bonds.
      c. Overhead and profit.
      d. Justification for any change in Contract Time.
      e. Credit for deletions from Contract, similarly documented.
      f. Supplier quotes to support the requested change.
      g. Subcontractor proposals with manufacturer/supplier documentation to support the requested change.
   2. Support each claim for additional costs with additional information:
      a. Origin and date of claim.
      b. Dates and times work was performed, and by whom.
      c. Time records and wage rates paid.
      d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.

G. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

H. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.

I. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

J. Promptly enter changes in Project Record Documents.

1.5 APPLICATION FOR PAYMENT AT SUBSTANTIAL COMPLETION

A. After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

B. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.

C. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

D. Completed and signed LEED Credit Templates for all points falling under Contractor responsibility.

1.6 APPLICATION FOR FINAL PAYMENT

A. Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
   1. Evidence of completion of Project closeout requirements.
   2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
   3. Updated final statement, accounting for final changes to the Contract Sum.
   4. AIA Document G706, “Contractor's Affidavit of Payment of Debts and Claims.”
   5. AIA Document G707, “Consent of Surety to Final Payment.”
   6. Evidence that claims have been settled.
   7. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
   8. Final liquidated damages settlement statement.

B. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.

C. Final Payment - Requires Prince George’s County Board of Education approval prior to final release of payment.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

Section 01 2100
Allowances

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cash allowances.

B. Contingency allowance.

C. Inspecting and testing allowances.

D. Payment and modification procedures relating to allowances.

E. Summary - A "Schedule of Allowances," showing amounts included in Contract Sum, is included in this section. Coordinate allowance to ensure that each section is completely integrated and interfaced. Requirements for allowances are shown and specified to extent established by date of Contract Documents; additional requirements will be established by Change Order. At earliest possible date, advise Architect/Engineer of date each final allowance selection must be completed. Submit proposals for allowance Work as directed and in manner specified for Change Orders. Indicate quantities, unit costs, total purchase amounts, taxes, delivery charges and trade discounts. Where requested, furnish a detailed breakdown of quantity survey. Contractor mark-up of overrun of allowance purchases will be permitted where purchase amount exceeds established allowance by more than 15%; otherwise, and except as otherwise indicated, amount of Change Order on each allowance will be the difference between purchase amount and allowance. Deliver excess materials of allowance Work to Owner's storage space, or dispose of by other means as directed. Designate in project construction schedule delivery dates for products and services specified under each allowance. Contingency allowances may be drawn upon in accordance with guidelines put forth in Article 7, Changes in the Work, of General Conditions.

1.02 RELATED REQUIREMENTS

A. Section 01 2000 - Price and Payment Procedures: Additional payment and modification procedures.

B. Document Summary "E" located above.

1.03 CASH ALLOWANCES

A. Costs Included in Cash Allowances: Cost of product to Contractor or subcontractor, less applicable trade discounts, less cost of delivery to site , less applicable taxes .

B. Architect Responsibilities:

1. Consult with Contractor for consideration and selection of products, suppliers, and installers.

C. Contractor Responsibilities:

1. Assist Architect in selection of products, suppliers , and installers.
2. Obtain proposals from suppliers and installers and offer recommendations.
3. On notification of which products have been selected, execute purchase agreement with designated supplier and installer.
4. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
5. Promptly inspect products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.
6. Differences in costs will be adjusted by Change Order.

1.04 CONTINGENCY ALLOWANCE

A. Funds will be drawn from the Contingency Allowance only by the issuance of an Allowance Deduction Authorization (ADA).

B. At closeout of Contract, funds remaining in Contingency Allowance will be credited to Owner by Change Order.

C. Payment for allowance items shall be made regularly by Contractor to suppliers of allowance items as work progresses. Contractor shall invoice for allowance items through periodic applications for payment as Work progresses.

1.05 INSPECTING AND TESTING ALLOWANCES

1.06 ALLOWANCES SCHEDULE

A. Contingency Allowance: Include the stipulated sum/price of $[100,000] for use upon Owner's instructions. This is the allowance amount to be included in the base bid. The stiplulations are as follows.

1. This amount will be utilized for unforeseen conditions to cover extra labor and material costs, if any, and shall be tracked separately from other contract costs. All mark-up, including general conditions, overhead, profit, etc., for this allowance shall be included in the base bid. No additional or credited markup will be allowed for extra work paid for by this allowance.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

PGCPS

ALLOWANCE
DEDUCTION AUTHORIZATION (ADA)

Distribution to:

PGCPS	☑
ARCHITECT	☑
CONTRACTOR	☑

PROJECT:
SCHOOL NAME:

ALLOWANCE NO.:
COST PROPOSAL NO.:

TO CONTRACTOR:

INITIATION DATE:

PSCP NO:
CONTRACT FOR:
CONTRACT DATE:

Please ☐ add / ☐ deduct cost value of the following item(s) ☐ to / ☐ from this allowance for the above referenced school project.

Check one	☑ Signage Allowance	$ 0.00
	☑ Contingency Allowance (unforseen conditions)	$ 0.00
	☑ Testing Allowance	$ 0.00

Sum of original Contract Allowances	$ 0.00
Net change by previously authorized Allowance Deduction Authorities	$ 0.00
Balance of remaining Allowances prior to this Allowance Deduction Authorization	$ 0.00
Total Allowance amount requested in this authorization	$ 0.00
Balance of remaining Allowances	$ 0.00

The contract time will be ■ (increased) ■ (decreased) ■ (unchanged) by Zero . (0) Days
The date of Substantial Completion as of the date of this authorization therefore is unchanged

NOT VALID UNTIL SIGNED BY THE ARCHITECT , CONTRACTOR AND OWNER.

ARCHITECT (Firm name)	**CONTRACTOR (Firm name)**	**OWNER (Firm name)** Department of Capital Programs, Prince George's Co. Public Schools
ADDRESS	**ADDRESS**	**ADDRESS** 13300 Old Marlboro Pike, Upper Marlboro, Maryland 20772
BY (Signature)	**BY (Signature)**	**BY (Signature)**
BY (Typed Name & Title)	**BY (Typed Name & Title)**	**BY (Typed Name & Title)**
DATE	**DATE**	**DATE**

SECTION 01230 - ALTERNATES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Description of alternates.

1.2 ACCEPTANCE OF ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted alternates will be identified in the Owner-Contractor Agreement.

B. Coordinate related work and modify surrounding work to integrate the Work of each alternate.

1.3 SCHEDULE OF ALTERNATES

A. Alternate No. 1 -

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 2500
SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

1.02 DEFINITIONS

A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies and equipment.

1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.

a. Unavailability.

b. Regulatory changes.

2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.

a. Substitution requests offering advantages solely to the Contractor will not be considered.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. A Substitution Request for products, assemblies, materials and equipment constitutes a representation that the submitter:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.

2. Agrees to provide the same warranty for the substitution as for the specified product.

3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.

4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.

5. Waives claims for additional costs or time extension that may subsequently become apparent.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.

C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.

1. No specific form is required. Contractor's Substitution Request documentation must include the following:

a. Project Information:

b. Substitution Request Information:

c. Attached Comparative Data: Provide point-by-point, side-by-side comparison addressing essential attributes specified, as appropriate and relevant for the item:

d. Impact of Substitution:

D. Limit each request to a single proposed substitution item.

3.02 **SUBSTITUTION PROCEDURES DURING CONSTRUCTION**

A. Architect will consider requests for substitutions only within 60 days after date established in Notice to Proceed.

B. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.

C. Use the product specified if the Architect cannot make a decision on the use of a proposed substitute within the time allocated. Following acceptance of the substitution, the Contractor shall submit related information and the product data in accordance with Section 01300- Submittals.

D. Substitutions will not be considered under one or more of the following circumstances:

1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
2. Without a separate written request.
3. When acceptance will require revisions to the Contract Documents.
4. The Architect will consider requests for substitutions if received within 60 days AFTER
5. Notice to Proceed.
6. The Architect will only consider requests for substitution submitted by the Prime
7. Contractor whose work is involved.
8. No substitution requests will be considered from manufacturer’s representatives or
9. product vendors unless submitted through a prime contractor.

3.03 **RESOLUTION**

10. No substitution requests will be considered during the bid period.
11. Bids shall be based on products from one of the manufacturers specified or an
12. “or equal” product.
13. Transmit three (3) copies of each request for substitution for consideration.
14. Requests shall be on the Substitution Request Form found at the end of this Section.
15. Requests not meeting this procedural requirement will be returned with no action
16. taken.
17. Identify the product to be substituted in each request. Include related Specification
18. Section and Drawing numbers.

E. Conditions for Consideration: The Architect will receive and consider the Contractor's request for substitution when one or more of the following conditions are satisfied, as

A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.

determined by the Architect. Requests will be returned with no action taken if none of the following conditions are satisfied.

1. Extensive revisions to the Contract Documents are not required.
2. Proposed changes are in keeping with the general intent of the Contract Documents.

3. The specified product cannot be provided within the Contract Time. The Architect will not consider the request if the product cannot be provided as a result of the Contractor's failure to pursue the Work promptly.
4. The requested substitution offers the Owner a substantial advantage, in cost, time, or energy conservation.
5. The specified product cannot receive necessary approval by a governing authority.
6. The specified product cannot be provided in a manner that is compatible with other materials and where the Contractor certifies that the substitution will overcome the incompatibility.
7. The specified product cannot be coordinated with other materials and where the Contractor certifies that the proposed substitution can be coordinated.
8. The specified product cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provides the required warranty.

B. Architect will notify Contractor in writing of decision to accept or reject request.
1. Architect's decision following review of proposed substitution will be noted on the submitted form.
2. Conditions for Acceptance: Following evaluation by the Architect and in accordance with a Change Order, the Contractor may make a substitution only with the consent of the Owner.

3.04 **ACCEPTANCE**

A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

3.05 **CLOSEOUT ACTIVITIES**

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

END OF SECTION

Section 01 2600
Contract Modification Procedures

PART 1 GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1. MINOR CHANGES IN THE WORK

2. Architect will issue through Construction Manager supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

1.02 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue through Construction Manager a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

B. Work Change Proposal Requests issued by Architect through Construction Manager are not instructions either to stop work in progress or to execute the proposed change.

C. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

D. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.

E. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

F. Include costs of labor and supervision directly attributable to the change.

G. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

H. Quotation Form: Use CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail."

I. Maximum Contractors markup (OH & Profit) shall be limited to as follows:

1. General Contractor – In the case when the contractor self performs the work with their OWN forces, fifteen percent (15%) of the total cost of the work associated with the change order for overhead, profit, supervision, and miscellaneous expenses will be allowed.

2. General Contractor – In the case when the contractor does not self-perform the work and the work is performed by a 1st – 3rd tier subcontractor, the contractor may add five percent (5%) of the total cost of the work associated with the change order for overhead, profit, supervision, and miscellaneous expenses.

3. 1st Tier Subcontractor – In the case when the contractor self performs the work with their OWN forces, fifteen percent (15%) of the total cost of the work associated with the change order for overhead, profit, supervision, and miscellaneous expenses will be allowed.

4. 1st Tier Subcontractor – In the case when the contractor does not self-perform the work and the work is performed by a 2nd – 3rd tier subcontractor, the contractor may add five percent (5%) of the total cost of the work associated with the change order for overhead, profit, supervision, and miscellaneous expenses. 2nd Tier Subcontractors will be allowed to add fifteen percent (15%) for work performed by their own forces.

J. Provide all supplier, subcontractor, manufacturer, etc backup to substantiate the proposed cost.

1. Substantiation of Costs: Provide full information required for evaluation of each submitted Change Order.

a. Support each claim with the following required data:

i. Quantities of products, labor, and equipment.

ii. Taxes, insurance, and bonds.

iii. Overhead and profit.

iv. Justification for any change in Contract Time.

v. Credit for deletions from Contract, similarly documented.

vi. Supplier quotes to support the requested change.

vii. Subcontractor proposals with manufacturer/supplier documentation to support the requested change.

b. Support each claim for additional costs with additional information:

i. Origin and date of claim.

ii. Dates and times work was performed, and by whom. c. Time records and wage rates paid.

iii. Invoices and receipts for products, equipment, and subcontracts, similarly documented.

c. Support each claim for additional requests for time with the required data:

i. CPM schedule illustrating the claimed delay impact to the Critical Path.

K. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Construction Manager.

L. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.

M. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.

N. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

O. Comply with requirements in Division 01 Section "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

P. Proposal Request Form: Use CSI Form 13.6A, "Change Order Request (Proposal)," with attachments CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail."

Q. Maximum Contractors markup (OH & Profit) shall be limited to 8% of the cost of the work associated with the change order.

R. Provide all supplier, subcontractor, manufacturer, etc backup to substantiate the proposed cost.

1.03 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Changes Proposal Request, Construction Manager will issue a Change Order for signatures of Owner and Contractor on form included in Project Manual.

1.04 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue through Construction Manager a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

B. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

C. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

D. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.05 PART 2 - PRODUCTS (NOT USED)

1.06 PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01270 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract and of the Contract Documents apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Sections:

1. Division 01 Section “Contract Modification Procedures” for procedures for submitting and handling Change Orders.
2. Division 01 Section “Quality Requirements” for general testing and inspecting requirements.

1.3 DEFINITIONS

A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Unit Price No. 1:

END OF SECTION 01270

SECTION 01300 - ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Preconstruction meeting.

B. Progress meetings.

C. Construction progress schedule.

D. Submittal Schedule.

E. Coordination drawings.

F. Submittals for review, information, and project closeout.

G. Submittal procedures.

1.2 PROJECT COORDINATION

A. Project Coordinator: Contractor.

B. Cooperate with the Project Coordinator in allocation of mobilization areas of site; for field offices and sheds, for site access, traffic, and parking facilities.

C. During construction, coordinate use of site and facilities through the Project Coordinator.

D. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.

E. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities.

F. Coordinate field engineering and layout work under instructions of the Project Coordinator.

G. Make the following types of submittals to Architect through the Project Coordinator:
   1. Requests for interpretation.
   2. Requests for substitution.
   3. Shop drawings, product data, and samples.
   4. Test and inspection reports.
   5. Design data.
   6. Manufacturer's instructions and field reports.
   7. Applications for payment and change order requests.
   8. Progress schedules.
   9. Coordination drawings.
   10. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 PRECONSTRUCTION MEETING

A. Attendance Required:
   1. Owner.
   2. Architect.
   3. Contractor.

B. Agenda:
   1. Execution of Owner-Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   3. Distribution of Contract Documents.
   4. Submission of list of Subcontractors, schedule of values, and progress schedule.
   5. Designation of personnel representing the parties to Contractor, Owner and Architect.
   6. Procedures and processing of field decisions, submittals, and substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   7. Scheduling.

C. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.2 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work at maximum bi-monthly intervals.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required: Job superintendent, major Subcontractors and suppliers, Owner, Architect, as appropriate to agenda topics for each meeting.

D. Agenda:
   1. Review minutes of previous meetings.
   2. Review of Work progress.
   3. Field observations, problems, and decisions.
   4. Identification of problems that impede, or will impede, planned progress.
   5. Review of submittals schedule and status of submittals.
   6. Review of off-site fabrication and delivery schedules.
   7. Maintenance of progress schedule.
   8. Corrective measures to regain projected schedules.
   9. Planned progress during succeeding work period.
   10. Coordination of projected progress.
   11. Maintenance of quality and work standards.
   12. Effect of proposed changes on progress schedule and coordination.
   13. Other business relating to Work.

E. Record minutes and distribute copies within two days after meeting to participants, with two

copies to Architect, Owner, participants, and those affected by decisions made.

3.3 CONSTRUCTION PROGRESS SCHEDULE

A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major contractors have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

3.4 SUBMITTAL SCHEDULE

A. Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and Construction Manager and additional time for handling and reviewing submittals required by those corrections. Architect reserves the rights to suspend review of submittals until a Submittal Schedule is received and accepted.
   1. Coordinate Submittal Schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
   2. Submit initial Submittal Schedule concurrently with initial Construction Progress Schedule. Include submittals required during the first 60 days of Work. Indicate the submittals required to maintain orderly progress of the Work and those required early due to long lead times for manufacture and/or fabrication.
   3. Submit revised Submittal Schedules to reflect changes to the status of the Work.
   4. Format: Arrange the following information in a tabular format:
      a. Scheduled date for first submittal.
      b. Specification Section number and title.
      c. Submittal Category: Action or Informational.
      d. Name of Subcontractor.
      e. Description of Work covered.
      f. Scheduled date for Architect's final release and/or approval.
      g. Scheduled date of fabrication.
      h. Scheduled dates for purchasing.
      i. Scheduled dates for installation.
      j. Activity or event number.

3.5 COORDINATION DRAWINGS

A. Provide information required by Project Coordinator for preparation of coordination drawings.

B. Review drawings prior to submission to Architect.

3.6 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.

3. Samples for selection.
4. Samples for verification.

B. Submit to Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.

C. Samples will be reviewed only for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below.

E. The following submittals will require additional time for review which should be factored into the schedule:
1. Structural Steel
2. Interior Architectural Woodwork
3. Doors and Hardware
4. Aluminum Framed Entrances, Storefronts, and Curtainwall
5. Food Service Equipment
6. Library Furniture
7. Automatic Temperature Control System
8. Lighting

3.7 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
1. Design data.
2. LEED submittals and reports.
3. Certificates.
4. Test reports.
5. Inspection reports.
6. Manufacturer's instructions.
7. Manufacturer's field reports.
8. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner.

3.8 SUBMITTALS FOR PROJECT CLOSEOUT

A. When the following are specified in individual sections, submit them at project closeout:
1. Project record documents.
2. Operation and maintenance data.
3. Warranties.
4. Bonds.
5. Other types as indicated.

B. Submit for Owner's benefit during and after project completion.

3.9 NUMBER OF COPIES OF SUBMITTALS

A. Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
1. After review, produce duplicates.

2. Retained samples will not be returned to Contractor unless specifically so stated.

3.10 SUBMITTAL PROCEDURES

A. Transmit each submittal with form included in the project manual.

B. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.

C. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.

D. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.

E. Schedule submittals to expedite the Project, and coordinate submission of related items.

F. For each submittal for review, allow 21 days excluding delivery time to and from the Contractor.

G. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.

H. Provide space for Contractor and Architect review stamps.

I. When revised for resubmission, identify all changes made since previous submission.

J. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.

K. Submittals not requested will not be recognized or processed.

END OF SECTION

SECTION 01 3050
DESIGN PROCEDURES AND SUBSTANTIATION REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for design of the facility, based on the design criteria specified.
B. Substantiation requirements.

1.02 RELATED REQUIREMENTS

A. Section 00 7100 - Contracting Definitions: Definitions of time periods and phase names.

1.03 DEFINITIONS

A. Substantiation: All forms of evidence that are used to predict whether the design will comply with the requirements or to verify that the construction based on the design actually does comply. During Preliminary Design, Design Development, and Construction Documents, requirements to submit substantiation are primarily intended to forestall use of designs or constructions that will not comply. At any time before completion of construction, substantiation is presumed to be only a prediction and may subsequently be invalidated by actual results. The term substantiation is used to distinguish these forms of evidence from traditional submittals commonly required during the construction phase.
B. Proven-In-Use: Proven to comply by having actually been built to the same or very similar design with the same materials as proposed (specified) and functioning as specified.
C. Proven-by-Mock-Up: Compliance reasonably predictable by having been tested in full-scale mock-up using the same materials and design as proposed (specified) and functioning as specified. Testing need not have been accomplished specifically for this project; when published listings of independent agencies include details of testing and results, citation of test by listing number is sufficient (submittal of all test details is not required).

1.04 REFERENCE STANDARDS

A. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection 2018.

1.05 SUBMITTALS

A. Substantiation Submittal Procedures:
   1. Time Frames: As specified. If there is a conflict between the degree of detail or completion specified and the progress of the design or construction, obtain a clarification before submitting (a clarification will be obtained before submitting).
   2. Recipient: Owner's project manager, at [_____].
   3. Number of Copies: 2 copies for Owner's use and records; Owner will return not more than one additional copy.
   4. For time periods that constitute Milestones, all substantiation submittals required during that period must be complete and accepted before the Milestone can be considered achieved.
   5. Resubmissions: Clearly identified as such, with all changes made since the original submittal clearly marked.
B. Owner's Review of Substantiation: Unless otherwise indicated, Owner will make formal acceptance of substantiation submittals.
   1. If a submittal is not acceptable Owner will notify Design-Builder promptly.
   2. Allow minimum of 15 working days for review of major "end of period" submittals.
C. Substantiation Schedule: Prepare and maintain (Contract will include preparation and maintenance of) a complete schedule of substantiation items, showing:
   1. Contents, for each item:
      a. Anticipated and actual item, with Section and paragraph number and drawing identification, if any.
      b. Anticipated submittal date, or time period(s) during which submittal is required.
      c. Actual submittal date.

d. Action taken or other status.
e. Identification of future re-submission requirement, if any.

2. If desired, schedule may be incorporated into overall progress schedule, provided substantiation data can be reported separately from other progress information.
3. Submission: To Owner, within 30 days after notice to proceed.
4. Form: Computer database format for Owner's use in tracking submittals; database structured so Owner's added information will not be overwritten or deleted by incorporation of updated data from Design-Builder.
5. Updates: To Owner, monthly in hard copy.

1.06 **QUALITY ASSURANCE**

A. Qualifications of Testing/Inspection Agencies Performing Substantiation:
1. Qualified and equipped to perform applicable tests/inspection.
2. Regularly engaged in testing and inspection activities on a commercial basis.
3. Independent of Design-Builder and Design-Builder's contractors' organizations.
4. Authorized to operate in the State in which the project is located.
5. Acceptable to Owner.
6. Substantiation: Submittal of qualifications, based on ASTM E329.

PART 2 PRODUCTS

2.01 **OWNER-FURNISHED PRODUCTS**

A. Owner-furnished products for this project are:
B. Developer team will arrange for and deliver shop drawings and other submittals, arrange and pay for delivery to site, perform joint inspection after delivery, submit claims for transportation damage, replace items damaged prior to delivery, replace defective items and arrange for manufacturer inspections, service, and warranties.

2.02 **DESIGN-BUILDER FURNISHED PRODUCTS**

A. In addition to requirements specified in other sections, provide products and elements that comply with the following.
B. Where "no substitutions" is indicated, use only the product (or one of the products) specified.
C. Elements Made Up of More Than One Product:
1. Where an element is specified by performance criteria, use (the project will use) construction either proven-in-use or proven-by-mock-up, unless otherwise indicated.
a. The Design-Builder may choose whether to use elements proven-in-use or proven-by-mock-up, unless either option is indicated as specifically required.
b. Where test methods accompany performance requirements, use those test methods (those test methods will be used) to test the mock-up.
2. Where a type of product is specified, without performance criteria specifically applicable to the element, use (the project will use) the type of product specified.
3. Where more than one type of product is specified, without performance criteria specifically applicable to the element, use (the construction will use) one of the types of products specified.
4. Where a type of product is specified, with applicable performance criteria, use (the construction will use) either the type of product specified or another type of product that meets the performance criteria as proven-in-use or proven-by-mock-up.
5. Where more than one type of product is specified, with applicable performance criteria, use (the construction will use) either one of the types of products specified or another type of product that meets the performance criteria as proven-in-use or proven-by-mock-up.
6. Where neither types of products nor performance criteria are specified, use (the construction will use) products that will perform well within the specified life span of the building.

D. Products:

1. Where a product is specified only by a manufacturer name and model number/brand name, use (the construction will use) only that model/brand product.
2. Where the properties of a product are specified by description and/or with performance criteria, use (the construction will use) products that comply with the description and/or performance criteria.
3. Where manufacturers are listed for a particular product, use (the construction will use) a product made by one of those manufacturers that also complies with other requirements.

E. Reference Standards: Where products or workmanship is specified by reference to a document not included in Contract Documents, comply (the construction will comply) with the requirements of the document, except where more stringent requirements are specified.
1. Date of Issue: As indicated in each instance except where a specific date is established by code.
2. Copies on Site: Keep (Contract will include obtaining and maintaining) copies of referenced standards that prescribe installation or workmanship standards on site until completion.

PART 3 EXECUTION

3.01 **DESIGN**

A. During Preliminary Design, the design criteria and the design itself must be (will be) refined, finalized, and documented.
B. Owner will appoint representatives of the following departments to provide details of functional needs:
1. User groups.
2. Food service staff.
3. Operations staff.
4. Maintenance staff.
5. Owner's commissioning agent.

C. Design Documentation: Record (Documentation will include) all design and performance criteria that will be of use during occupancy and operation of the project, including all items specified for maintenance manuals, below.
1. Design Criteria Documentation Included in Construction Documents: Organized logically (from the point of view of operations staff) and placed in a prominent location in drawing sets.
2. If desired, documentation may consist of annotated modifications to and amplification of the Conceptual Documents, with changes that affect Contract Times or Contract Price documented as required for modifications.
3. If required, shop drawings may be used to accomplish design documentation.
4. Owner will maintain the project program document, modified to reflect changes made during refinement of the design.
5. Drawings: Prepared using AutoCAD R14, using Owner's specified drawing and layering conventions.
6. Shop Drawings: Prepared using same CAD software.
7. Mock-Ups: Where necessary to clarify design intent and obtain approvals, construct full-scale mock-ups (full-scale mock-ups will be constructed).

3.02 **PROGRESS DOCUMENTATION**

A. Progress Schedule: As specified in the Conditions of the Contract.
1. Submit updated schedule (Updated schedule will be submitted) whenever adjustments that change the Contract Times or Milestones are approved.

B. Progress Documentation for Owner Information:
1. During Preliminary Design, Design Development, and Construction Documents Periods: Graphic displays sufficiently detailed to allow individual departments to identify the status of the design of their new spaces.
2. During Construction and Closeout: Photographs and graphic displays sufficiently detailed to allow individual departments to identify the status of the construction of their new spaces.

C. Progress Documentation for Owner's Project Record:

1. During Construction: Daily digital photographic record of each portion of the work, taken from consistent locations, distances, and angles.
2. During Construction: Time-lapse video record of site activity from a single vantage point located so as to view most of the site; views taken at one hour intervals from just before ground breaking until completion of enclosure and again during site finishing activities until Substantial Completion.
3. During Closeout: Detailed digital photographic record of each interior room and space, each exterior elevation, the roof, all site areas and [_____].
4. Photographs and Videos: Include the date taken, a short title of the view, and the compass orientation in each view; data must be in the actual photograph or frame, rather than added after printing.

3.03 **PERFORMANCE OF SUBSTANTIATION**

A. In addition to the requirements stated in other sections, provide (we will provide) the following substantiation of compliance at each stage of the project:
   1. If a substantiation requirement is specified without an indication of when it is to be submitted, submit or execute (we will submit or execute) it before the end of Construction Documents.
   2. See also the Agreement and Conditions of the Contract for submittal requirements.

B. Submit (Contract will include submission of) complete sets of documents containing all substantiation at end of the following periods:
   1. Proposal period.
   2. Preliminary Design period.
   3. Design Development period.
   4. Construction Documents period.

C. Proven-In-Use: Where elements proven-in-use are used to comply with performance requirements:
   1. In the Proposal, identify (we will identify) which elements will be accomplished using proven-in-use elements.
   2. During Design Development, identify (we will identify) proven-in-use elements proposed for use, including building name, location, date of construction, owner contact, and description of design and materials in sufficient detail to enable reproduction in this project.

D. Proven-By-Mock-Up: Where elements proven-by-mock-up are used to comply with performance requirements:
   1. In the Proposal, identify (we will identify) which elements will be accomplished using proven-by-mock-up elements.
   2. During Design Development, identify (we will identify) proven-by-mock-up elements proposed for use, with test report including date and location of test, name of testing agency, and description of test and mock-up.
   3. Mock-up testing need (may) not have been performed specifically for this project, provided the mock-up is substantially (but the mock-up will be very) similar in design and construction to the element proposed.

E. Design Analyses (including Engineering Calculations):
   1. Where a design analysis or calculation is specified without identifying a particular method, perform analysis (analysis will be performed) in accordance with accepted engineering or scientific principles to show compliance with specified requirements, and submit (with) report that includes analysis methods used and the name and qualifications of the designer.
   2. Where engineering design is allowed to be completed after commencement of construction, substantiation may be in the form of shop drawings or other data.
   3. Submit design analyses (Design analyses will be submitted) at the end of Design Development unless otherwise indicated.
   4. Where design analysis is specified to be performed by licensed design professional, use (we will use) a design professional licensed in Maryland.

F. Substantiation for Products:
   1. Where actual brand name products are not identified by either the Owner or the Design-Builder, identify (we will identify) the products to be used.
   2. In the Proposal:
      a. Identify (We will identify) one or more product types for each system, assembly, or element.
      b. For each product type, provide (we will provide) brief descriptive or performance specifications.
      c. For major manufactured products that are commonly purchased by brand name, and any other products so indicated, identify (we will identify) at least one manufacturer that will be used.
   3. During Preliminary Design or Design Development:
      a. Where more than one product type is identified for a particular system, assembly, or element, identify (we will identify) exactly which type will be used.
      b. For each product type, provide (we will provide) descriptive or performance specifications; early submittals may (will) be brief specifications, but complete specifications are required (will be provided) prior to completion of construction documents.
      c. For each product type, identify (we will identify) at least one manufacturer that will be used.
      d. For major manufactured products that are commonly purchased by brand name, and any other products so indicated, provide (we will provide) manufacturer's product literature on at least one actual brand name product that meets the specifications, including performance data and sample warranty.
   4. During Construction:
      a. Identify (We will identify) actual brand name products used for every product, except commodity products specified by performance or description.
      b. Where a product is specified by performance requirements with test methods, and if so specified, provide (we will provide) test reports showing compliance.
      c. Provide (We will provide) manufacturer's product literature for each brand name product.
      d. Provide (We will provide) the manufacturer's certification that the product used on the project complies with Contract Documents.
   5. Before End of Closeout:
      a. Provide (We will provide) copies of all manufacturer warranties that extend for more than one year after completion.

G. Regardless of whether substantiation is specified or not, the actual construction must (will) comply with the specified requirements and may, at the Owner's discretion, be examined, inspected, or tested to determine compliance.
   1. Substantiation submittals will not be approved or accepted, except to the extent that they are part of documents required to be approved or accepted in order to proceed to the next stage of design or construction. However, approval or acceptance of substantiation will not constitute approval or acceptance of deviations from the specified requirements unless those deviations are specifically identified as such on the submittal.
   2. The Owner accepts the responsibility to review substantiation submittals in a timely manner and to respond if they are unacceptable.

3.04 FIELD TESTING AND INSPECTION AS SUBSTANTIATION

A. Perform (Construction operations will include) all testing , observation, and inspection required by code and as specified.
   1. Exception: Tests and inspections indicated to be performed by Owner's commissioning agent or other independent agency.

B. Reports: Written report of each test/inspection; including complete details of conditions, methods, and results, signed by responsible individual.

3.05 **POST-OCCUPANCY SURVEY AS SUBSTANTIATION**

A. Post-Occupancy Survey: Conducted by Owner, of actual occupants after minimum of two weeks of full occupancy and operation and again after 90 days.

B. See Agreement and Conditions of the Contract for terms of provisions relating to results of post-occupancy survey.

C. Purpose of Survey: Subjective evaluation of function and quality of occupants' spaces and project as a whole. Survey questions will include:

1. Were the final design and features communicated to you before construction began?
2. Have the functional needs you identified as important been provided?
3. Was the progress of construction of the new building communicated to you on a regular basis?
4. Is the room temperature in your work area comfortable? Is the performance of the heating/air conditioning system acceptable?
5. Does the amount of direct lighting in your work area meet your needs and expectations?
6. Does the amount of outside natural light into your work area meet your expectations based on the design and location of your work area?
7. Is noise from other work areas or outside sources not objectionable in your work area?
8. Does the performance of the equipment you use in your work area meet your expectations? (Excluding owner-provided equipment.)
9. Does the appearance of the building both inside and outside project the appropriate image to the community and our customers?
10. Is the building user-friendly? Have features been placed where they are convenient and readily accessible?
11. Does the quality of construction meet your expectations? Do finishes, trim, and painting demonstrate the expected level of quality?
12. Were you provided with an appropriate level of orientation regarding the features of the new building before move-in?
13. Is the number of corrective repairs or warranty claims during the first 90 days of occupancy less or more than you would expect with a major new facility?
14. How would you rate the new building, overall, on a scale of 1 to 10 (lowest to highest), realizing that it would be impossible to completely please everyone?

END OF SECTION

SECTION 01320 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provisions of the Contract apply to this Section.

1.2 SUBMITTALS (for information only; no action will be taken by the Architect)

A. Submittal Schedule: Submit three copies of schedule. Arrange the following information in a tabular format:
   1. Scheduled date for each submittal.
   2. Specification Section number and title.
   3. Submittal category (action or informational).
   4. Name of subcontractor.
   5. Description of the Work covered.
   6. Scheduled date for Architect's final release or approval.

B. Contractor's Construction Schedule: Submit two opaque copies of initial schedule, large enough to show entire schedule for entire construction period.
   1. Submit an electronic copy of schedule, using Primavera P6 software, on CD-R, and labeled to comply with requirements for submittals. Include type of schedule (Initial or Updated) and date on label.

C. Daily Construction Reports: Submit two copies at monthly intervals.

D. Field Condition Reports: Submit two copies at time of discovery of differing conditions.

E. Special Reports: Submit two copies at time of unusual event.

1.3 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's Construction Schedule with the Submittals Schedule, and other required schedules and reports.
   1. Secure time commitments for performing critical elements of the Work from parties involved.
   2. Coordinate each construction activity with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 SUBMITTAL SCHEDULE

A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by Contractor’s Construction Schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.

1. Coordinate Submittals Schedule with Contractor's Construction Schedule.
    a. At Contractor's option, show submittals on the Construction Schedule, instead of tabulating them separately.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. Procedures: Prepare precedence diagram network using AON (activity-on-node) format. Comply with procedures contained in AGC's "Construction Planning & Scheduling."

B. Time Frame: Extend schedule from date established for Commencement of the Work to date of Final Completion.
    1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Preliminary Network Diagram: Submit diagram within 14 days of date established for Commencement of the Work. Outline significant construction activities for the first 60 days of construction. Include skeleton diagram for the remainder of the Work based on indicated activities.

D. CPM Schedule: Prepare Contractor's Construction Schedule using a computerized, time-scaled CPM network analysis diagram for the Work.
    1. Develop network diagram for Owner review no later than 30 days after date established for Commencement of the Work.
        a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all Work within applicable completion dates.
    2. Use "one workday" as the unit of time. Include list of nonworking days and holidays incorporated into the schedule.

E. Activities: Treat each story or separate area as a separate activity for each principal element of the Work. Comply with the following:
    1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
    2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
    3. Submittal Review Time: Include reasonable review periods and adequate time for resubmittals in the schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
        a. Identify the minimum 30-day time period allowed for color selection activity conducted by Owner and Architect to result in project color schedule.
    4. Startup and Testing Time: As a predecessor to Substantial Completion include activities of reasonable duration for startup and testing of equipment. Schedule should include activities for individual / specific areas, not just one activity for entire project.
    5. Building Commissioning and Testing: As a predecessor to Substantial Completion include a reasonable duration period for building commissioning and testing.
    6. Substantial Completion: Indicate completion of work activities in advance of the date established for Substantial Completion, and include separate activities for Architect's administrative procedures necessary for certification of Substantial Completion.

F. CPM Schedule Preparation and Constraints: Prepare a list of all activities required to complete the Work. Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
    1. Phasing: Arrange list of activities on schedule by phase.

2. Work by Others: Include a separate activity for each portion of the Work performed by Owner or other contractors necessary for the completion of the Work.
3. Owner-Furnished Products: Include a separate activity for each product. Coordinate delivery dates established by Owner with the project schedule.
4. Owner-Furnished Permanent Utilities: Include separate activities indicating when permanent utilities are required.
5. Activities and Work Restrictions: Indicate estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames and show the effect of the following items on the schedule as applicable:
    a. Coordination with existing construction.
    b. Limitations of continued occupancies.
    c. Utility interruptions.
    d. Uninterruptible services.
    e. Partial occupancy before Substantial Completion.
    f. Use of premises restrictions.
    g. Provisions for future construction.
    h. Seasonal variations.
    i. Environmental control.
    j. Preparation and processing of submittals.
    k. Mobilization and demobilization.
    l. Work by Owner that may affect or be affected by Contractor's activities.
6. Work Stages: Indicate estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
    a. Fabrication.
    b. Installation.
    c. Tests and inspections, including commissioning.
    d. Adjusting.
    e. Startup and placement into final use and operation.
7. Area Separations: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
    a. Structural frame completion.
    b. Permanent building enclosure.
    c. Substantial Completion of mechanical installation.
    d. Substantial Completion of electrical installation.
    e. Substantial Completion.
    f. Final Completion.
8. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
9. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.

G. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed (Commencement of the Work), Substantial Completion, and Final Completion.

H. Initial Issue of Schedule: Prepare initial network diagram from a list of straight "late finish-total float" sort. Identify critical activities. Prepare tabulated reports showing the following:
1. Description of activity.
2. Early and late start dates.
3. Early and late finish dates.

4. Activity duration in workdays.
5. Total float or slack time.

I. Submittal of the Final Construction Schedule by the Contractor certifies that the work will be prosecuted in accordance with the Schedule, subject to any change therein which is implemented in accordance with the Contract Documents

J. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of all activities and relationships that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

K. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragments to demonstrate the effect of the proposed change on the overall project schedule.

L. Computer Software: Prepare schedules using Primavera P6 or alternate software acceptable to Owner and Architect.

2.3 RECOVERY SCHEDULE

A. Should the updated Construction Schedule show at any time during Contractor's performance, in the sole opinion of the Owner, that the Contractor is fourteen (14) or more days behind schedule for any Specific Date, or should Contractor be required to undertake actions under the General Conditions hereof, the Contractor shall prepare a Recovery Schedule at no additional cost to the Owner explaining and displaying how Contractor intends to reschedule the Work in order to regain compliance with the Construction Schedule during the immediate subsequent pay period.

B. Recovery Schedule Requirements:

1. The Contractor shall prepare and submit to the Owner a one-month maximum duration Recovery Schedule, which demonstrates how the progress of the Work will return to the approved Construction Schedule at the earliest possible time. Prepare the Recovery Schedule to same level of detail as the Construction Schedule. This Recovery Schedule shall be prepared in coordination with other separate contractors on the Project.
2. Contractor shall advise the Owner of the effectiveness of the Recovery Schedule during the schedule recovery time period. At the conclusion of the one month schedule recovery period, the Owner will direct the Contractor as follows:
   a. If Owner determines the Contractor is still behind schedule, Owner will direct the Contractor to prepare a Schedule Revision and comply with all of the requirements of a Schedule Revision as stated herein and the other requirements of the Contract Documents; provided, however, that nothing herein shall limit in any way the rights and remedies of the Owner as provided elsewhere in the Contract Documents.
   b. If the Owner determines the Contractor has successfully complied with provisions of the Recovery Schedule, the Owner will direct the Contractor to return to the use of the approved Construction Schedule.

2.4 SCHEDULE REVISIONS

A. Should Contractor desire to or be required under the Contract Documents to make modifications or changes in his method of operation, his sequence of Work or the durations of activities in the Construction Schedule, the Contractor shall do so in accordance with requirements of Contract

Documents. Revisions to the approved Construction Schedule shall be identified by Contractor in writing and approved in writing by Owner prior to incorporation into the approved schedule.

B. Logic modifications associated with change orders shall affect only those activities and performance dates directly concerned. Adjustments in scheduled intermediate Completion Dates or for the Contract as a whole will be considered only to the extent that there is insufficient remaining float to absorb these changes.

C. Revisions to Contractor's Construction Schedule required under terms of this Section shall not modify the Contract Time or any Milestone Date and shall not modify or limit the Contractor's obligations under this Contract.

D. If there are separate contractors on the Project, prior to the submission by the Contractor of proposed schedule revision, the Contractor shall meet with and gain written approval of the separate contractors to make the revisions which shall be evidenced by the signatures of said separate contractors on the proposed schedule revisions. If accepted by the Owner the revisions shall be binding upon Contractor and all separate contractors on the Project.

1. Separate contractors include hazardous material remediation contractor. Schedule shall address testing and monitoring associated with remediation.

E. Submittal of any proposed schedule revisions by the Contractor certifies that he will prosecute the Work in accordance with the schedule revision, subject to any change therein which is implemented in accordance with the Contract Documents.

2.5 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording, at a minimum, the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions.
7. Meetings and significant decisions.
8. Unusual events (refer to special reports).
9. Stoppages, delays, shortages, and losses.
10. Meter readings and similar recordings.
11. Orders and requests of authorities having jurisdiction.
12. Change Orders received and implemented.
13. Construction Change Directives received and implemented.
14. Services connected and disconnected.
15. Equipment or system tests and startups.
16. Partial Completions and occupancies.
17. Substantial Completions authorized.

B. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report with a request for interpretation on CSI Form 13.2A or alternate form acceptable to Architect. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.6 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of

results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week in advance of the regularly scheduled monthly meeting designated for the review of the project schedule by the Architect.

1. Revise schedule after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate Actual Start Dates, Actual Finish Dates and an accurate Completion Percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect, Owner, and additional parties determined by the Contractor.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01320

SECTION 01321 - CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, bar chart type.

1.2 RELATED SECTION

A. Section 01100 - Summary:

1.3 REFERENCES

A. AGC (CPSM) - Construction Planning and Scheduling Manual; Associated General Contractors of America.

B. M-H (CPM) - CPM in Construction Management - Project Management with CPM, O'Brien, McGraw-Hill Book Company.

1.4 SUBMITTALS

A. Within 10 days after date of Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

F. Submit under transmittal letter form specified in Section 01300.

1.5 SCHEDULE FORMAT

A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.

B. Sheet Size: Multiples of 8-1/2 x 11 inches.

C. Scale and Spacing: To allow for notations and revisions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.2 BAR CHARTS

A. Include a separate bar for each major portion of Work or operation.

B. Identify the first work day of each week.

3.3 NETWORK ANALYSIS

A. Prepare network analysis diagrams and supporting mathematical analyses using the Critical Path Method.

B. Illustrate order and interdependence of activities and sequence of work; how start of a given activity depends on completion of preceding activities, and how completion of the activity may restrain start of subsequent activities.

C. Mathematical Analysis: Tabulate each activity of detailed network diagrams, using calendar dates, and identify for each activity:
   1. Preceding and following event numbers.
   2. Activity description.
   3. Estimated duration of activity, in maximum 15 day intervals.
   4. Earliest start date.
   5. Earliest finish date.
   6. Actual start date.
   7. Actual finish date.
   8. Latest start date.
   9. Latest finish date.
   10. Total and free float; float time shall accrue to Owner and to Owner's benefit.
   11. Monetary value of activity, keyed to Schedule of Values.
   12. Percentage of activity completed.
   13. Responsibility.

D. Analysis Program: Capable of compiling monetary value of completed and partially completed activities, accepting revised completion dates, and recomputation of all dates and float.

E. Required Reports: List activities in sorts or groups:
   1. By preceding work item or event number from lowest to highest.
   2. By amount of float, then in order of early start.

3.4 REVIEW AND EVALUATION OF SCHEDULE

A. Participate in joint review and evaluation of schedule with Architect at each submittal.

B. Evaluate project status to determine work behind schedule and work ahead of schedule.

C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.5 UPDATING SCHEDULE

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity.

C. Annotate diagrams to graphically depict current status of Work.

D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

E. Indicate changes required to maintain Date of Substantial Completion.

F. Submit reports required to support recommended changes.

3.6 DISTRIBUTION OF SCHEDULE

A. Distribute copies of updated schedules to Contractor's project site file, to Subcontractors, suppliers, Architect, Owner, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedules.

END OF SECTION

SECTION 01330 SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's and Construction Manager's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's and Construction Manager's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

C. Info Exchange (Electronic File Transfer): The Info Exchange is a Web-enabled server that allows project team members to easily and securely exchange project files on a website.

D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.3 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and Construction Manager and additional time for handling and reviewing submittals required by those corrections. Architect reserves the right to suspend review of submittals until a Submittal Schedule is received and accepted.
   1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
   2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
   3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
      a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
   4. Format: Arrange the following information in a tabular format:
      a. Scheduled date for first submittal.
      b. Specification Section number and title.
      c. Submittal category: Action; informational.
      d. Name of subcontractor.
      e. Description of the Work covered.
      f. Scheduled date for Architect's and Construction Manager's final release or approval.
      g. Scheduled date of fabrication.

h. Scheduled dates for purchasing.
i. Scheduled dates for installation.
j. Activity or event number.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.
1. Architect will furnish Contractor electronic copies of requested drawings In AutoCAD 2011 "DWG" Format for use in preparing Shop Drawings.
a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to the Contract Drawings.
b. Contractor shall execute a data licensing agreement in the form of Agreement included at the end of this section.
c. Files will be provided through the Architect's Info Exchange
d. Electronic Structural Drawings will not be provided for use in producing structural steel shop drawing submittals.
e. The contractor shall pay the Architect a preparation and transfer fee of $250.00 per single AutoCAD "DWG" File.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Submit LEED submittals concurrently with product data with which they are related.
5. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
a. Architect and Construction Manager reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 15 business days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Construction Manager will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 business days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 business days for initial review of each submittal.
5. The following submittals will, by their nature, require additional time for review which should be factored into the schedule.
a. Structural Steel
b. Interior Architectural Woodwork
c. Doors & Hardware
d. Aluminum-Framed Entrances and Storefronts / Fire-Rated Entrances and Storefronts / Glazed Aluminum Curtain Walls / Aluminum Windows

e. Food Service Equipment
f. Laboratory Casework
g. Library Furniture
h. Hydraulic Elevators
i. Automatic Temperature Control System
j. Interior and Exterior Lighting

D. Electronic Submittals: All submittals excepting those listed under 01330.1.5.E shall be submitted electronically in PDF format.

E. Paper Submittals: The following submittals shall be submitted in hard copy.
1. Division 05-Metals
2. Interior Architectural Woodwork
3. Metal Roof Panels
4. Metal Wall Panels
5. Built-up Asphalt Roofing
6. Aluminum-Framed Entrances and Storefronts / Fire-Rated Entrances and Storefronts / Glazed Aluminum Curtain Walls / Aluminum Windows
7. Laboratory Casework
8. Submittals larger than 11" x 17".

F. Submittal Preparation:
1. Use the Submittal Cover Sheet provided at the end of this section to supply submittal identification. Paper copies shall have this Submittal Cover Sheet attached to each copy.
2. Drawing numbers, detail references, locations where product is to be installed and other necessary identification shall be provided in addition to the information required by the Submittal Cover Sheet.
3. Transmittal for Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return without review submittals received from sources other than Construction Manager.

G. Options: Identify options requiring selection by Architect.

H. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect and Construction Manager on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

I. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's and Construction Manager's action stamp.

J. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

K. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's and Construction Manager's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
   1. Action Submittals: Submit six paper copies of each submittal unless otherwise indicated. Architect, through Construction Manager, will return two copies.
   2. Informational Submittals: Submit four paper copies of each submittal unless otherwise indicated. Architect and Construction Manager will not return copies.
   3. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
      a. Provide a notarized statement on original paper copy certificates and certifications where indicated.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
   1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
   2. Mark each copy of each submittal to show which products and options are applicable.
   3. Include the following information, as applicable:
      a. Manufacturer's catalog cuts.
      b. Manufacturer's product specifications.
      c. Standard color charts.
      d. Statement of compliance with specified referenced standards.
      e. Testing by recognized testing agency.
      f. Application of testing agency labels and seals.
      g. Notation of coordination requirements.
      h. Availability and delivery time information.
   4. For equipment, include the following in addition to the above, as applicable:
      a. Wiring diagrams showing factory-installed wiring.
      b. Printed performance curves.
      c. Operational range diagrams.
      d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
   5. Submit Product Data before or concurrent with Samples.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
   1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
      a. Identification of products.
      b. Schedules.
      c. Compliance with specified standards.
      d. Notation of coordination requirements.
      e. Notation of dimensions established by field measurement.
      f. Relationship and attachment to adjoining construction clearly indicated.
      g. Seal and signature of professional engineer if specified.
   2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 24 by 36 inches.
   3. Submit Shop Drawings in the following format:

a. Six opaque copies of each submittal. Architect and Construction Manager will retain four copies; remainder will be returned.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
   1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
   2. Identification: Attach label on unexposed side of Samples that includes the following:
      a. Generic description of Sample.
      b. Product name and name of manufacturer.
      c. Sample source.
      d. Number and title of applicable Specification Section.
      e. Specification paragraph number and generic name of each item.
   3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
   4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
      a. Number of Samples: Submit two full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect, through Construction Manager, will return one submittal with options selected.
   5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
      a. Number of Samples: Submit four sets of Samples. Architect and Construction Manager will retain two Sample sets; remainder will be returned.
         1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
         2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
   1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
   2. Manufacturer and product name, and model number if applicable.
   3. Number and name of room or space.
   4. Location within room or space.

F. Coordination Drawing Submittals: Comply with requirements specified in Division 01 Section "Project Management and Coordination."

G. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."

H. Application for Payment and Schedule of Values: Comply with requirements specified in Division 01 Section "Price and Payment Procedures."

I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements."

J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Submittals."

K. Maintenance Data: Comply with requirements specified in Division 01 Section "Closeout Submittals."

L. LEED Submittals: Comply with requirements specified in Division 01 sustainable design requirements Section. LEED submittals shall be submitted concurrently with the product with which they are related. Architect may return without action product data or shop drawing submittals when LEED information has not been received at the same time.

M. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

N. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

O. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

P. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

Q. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

R. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

S. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

T. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

U. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
   1. Name of evaluation organization.
   2. Date of evaluation.
   3. Time period when report is in effect.

4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

V. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

W. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

X. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

Y. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
   1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit certification signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
   1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect and Construction Manager.

B. Project Closeout and Maintenance Material Submittals: See requirements in Division 01 Section "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp in space provided on the Submittal Cover Sheet provided at the end of this section. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of

Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents. Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

3.2 ARCHITECT'S AND CONSTRUCTION MANAGER'S ACTION

A. Action Submittals: Architect and Construction Manager will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect and Construction Manager will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:
   1. NO EXCEPTIONS TAKEN
   2. EXCEPTIONS AS NOTED
   3. REVISE & RESUBMIT
   4. REJECTED
   5. RESUBMIT FOR RECORD
   6. REVIEWED FOR INFO ONLY

B. Informational Submittals: Architect and Construction Manager will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect and Construction Manager will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect and Construction Manager.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION

SECTION 01 3329
SUSTAINABLE DESIGN REPORTING

PART 1 GENERAL

1.01 PROJECT GOALS

A. This project has been designed to achieve the LEED Certified (minimum 40 points) rating as defined in USGBC LEED v4-BD+C for New Construction and is pursuing MR Building Product Disclosure and Optimization and EQ Low-Emitting Materials Credits.

B. A Sustainable Design Consultant has been employed by Owner to review sustainable design documentation.

C. Contractor is not responsible for the application for certification, nor for determination of methods of achieving sustainable design credits unless specifically so indicated.

D. Many of the sustainable design credits can be achieved only through intelligent design of the project and are beyond the control of the Contractor. However, certain credits relate to the products and procedures used for construction. Therefore, the full cooperation of the Contractor and subcontractors is essential to achieving final certification.

E. Contractor shall familiarize himself with the relevant requirements and provide the necessary information and instruction to all subcontractors and installers.

F. Since Contractor and subcontractors may not be familiar with sustainable design requirements, this section includes a summary of the products and procedures intended to achieve sustainable design credits.

1. Some credits are dependent on proper performance by Contractor and subcontractors.
2. Other credits involve quantifying percentages by weight or volume and cost; these require careful recordkeeping and reporting by the Contractor.
3. See www.usgbc.org for more information.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Additional submittal requirements.

B. Section 01 3329.04 - Material Content Form: Form with checklist for documenting product content, emissions, health effects, sources, and costs.

C. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

1.03 DEFINITIONS

A. Product Reporting Scope: All products in the following product categories, whether specified or not:

1. Interior paints and coatings.
2. Interior adhesives and sealants, including flooring adhesives.
3. Flooring.
4. Composite wood.
5. Products making up wall and ceiling assemblies.
6. Thermal and acoustical insulation.
7. Wet-applied roofing and waterproofing.
8. Free-standing furniture.

1.04 REFERENCE STANDARDS

A. USGBC LEED v4-BD+C - LEED v4 for Building Design and Construction 2018.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for additional submittal procedures.

B. Sustainable Design Documentation: The scope of required documentation is specified in some individual specification sections; other scope is specified in this section and its related forms only.

C. New Product Documentation: For each new product in the Product Reporting Scope, submit the Material Content Form, with evidence of compliance attached.

D. Product Cost Statement: Submit the total cost of all products defined as in the Product Reporting Scope, above, including purchase price, taxes, and delivery to site, but not labor, tools, or equipment for installation; submit prior to or along with initial application for payment; update and re-submit whenever the total cost changes due to contract modifications.

1.06 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

A. Sustainable design documentation is to be in electronic (PDF) format and transmitted via an Internet-based submittal service that receives, logs and stores documents, notifies participants, and provides electronic submission to the certifying agency.

1. The types of submittals for which this service must be used include those for credits that relate to materials, and any others designated by Architect.
2. For credits for which achievement requires substantiation of material type, quantity, and cost, submit receipts showing purchase of materials for this project.
3. Contractor and Architect are required to use this service.
4. It is Contractor's responsibility to submit documents in PDF format.
5. Subcontractors, suppliers, and Architect's consultants are to be permitted to use the service at no extra charge.
6. Users of the service need an email address, Internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
7. Paper document transmittals will not be reviewed; emailed PDF documents will not be reviewed.
8. All other specified submittal and document transmission procedures apply, except that electronic document requirements to not apply to samples or color selection charts.

B. Cost: The cost of the service is to be paid by Contractor; include the cost of the service in the contract sum.

C. Submittal Service: The selected service is:

D. Training: One, one-hour, web-based training session will be arranged for all participants, with representatives of Architect and Contractor participating; further training is the responsibility of the user of the service.

E. Architect will also be using this service to identify materials and prepare sustainable design documentation and submissions. Contractor is encouraged to use any other features of the service that are useful.

F. Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PROCEDURES

A. Submit sustainable design documentation by Contractor, using procedures defined under Submittals for Information in Section 01 3000.

B. Use of electronic submittal service specified in this section is required.

C. Submit sustainable design documentation to Consultant, not to Architect, unless otherwise indicated.

D. Where an item of sustainable design documentation is specified, fill out and submit the appropriate form.

1. Fill out one form for each different brand name product and each different manufacturer of a lot of commodity products.
2. Where required attachments are specified, attach the documentation to the back of the form.
3. Mark each blank with the appropriate information; use "ATT" for items attached; if any item is not relevant use the code "NR"; if any item is not available use the code "NA".

E. Each form must be signed by the entity capable of certifying the information.

1. Certification signatures must be made by an officer of the company.
2. For products, certification must be made by the manufacturer not the supplier.
3. For custom fabricated products, certification by the fabricator is acceptable.

F. Submit the completed forms in accordance with the requirements of Section 01 3000, as information submittals.

1. Give each form a unique submittal number.
2. Do not combine sustainable design documentation with product data or shop drawing submittals.

G. Submit forms applicable to work for which application for payment is being made, either prior to or concurrent with application for payment; payment will not be made until relevant forms have been submitted.

H. For work covered by multiple applications for payment, the initial submittal of a form is sufficient for subsequent applications unless the nature of the product has changed.

3.02 DIVISION 1 - GENERAL REQUIREMENTS

A. Sections that include requirements intended to achieve sustainable design goals are, but are not limited to, the following:

B. Section 01 1000 - Summary:

1. List of materials and equipment to be salvaged from existing building for re-use or relocation on project.

C. Section 01 3329 - Sustainable Design Reporting: Requirements and procedures for sustainable design documentation.

D. Section 01 3329.04 - Material Content Form: Form with checklist for documenting product content, emissions, health effects, sources, and costs.

E. Section 01 3329.07 - Prohibited Content Installer Certification: Certification by each installer working on project regardless of product type.

F. Section 01 5713 - Temporary Erosion and Sediment Control: Preventive measures and remediation.

G. Section 01 5719 - Temporary Environmental Controls:

1. Basic construction procedures.
2. Testing of ventilation.
3. Full building flush out before occupancy is required.

H. Section 01 6000 - Product Requirements:
1. Definitions of:
a. Reused Products.
b. Recycled Content.
c. Bio-Based content.
d. Sustainably Harvested Wood, which is defined as certified by FSC only.
e. Source Location.
f. Environmental Product Declarations.
g. Health Product Declarations.
h. Cradle-to-Cradle.
i. GreenScreen Chemical Hazard Analysis.
j. Manufacturer's Inventory of Product Content.

I. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: List of indoor-emissions-restricted products and VOC-content-restricted products, requirements, evidence required, and reporting.

J. Section 01 7000 - Execution and Closeout Requirements:
1. Dust control and basic surface drainage.

K. Section 01 7419 - Construction Waste Management and Disposal: Requirements for landfill diversion and reporting.

L. Section 01 7800 - Closeout Submittals: Maintenance and operation manuals for commissioned systems.

M. Section 01 7900 - Demonstration and Training:
1. Demonstration of commissioned systems and equipment.
2. Training of Owner's personnel.

N. Section 01 9113 - General Commissioning Requirements.

O. Section 01 9114 - Commissioning Authority Responsibilities.

3.03 DIVISION 2 - EXISTING CONDITIONS

A. Section 02 4100 - Demolition:
1. Demolition of existing pavements and other impervious surfacing.
2. Partial demolition for preserving existing construction.

B. Section 02 8400 - Polychlorinate Biphenyl (PCB) Remediation: Abatement of PCBs, mercury, and other substances regulated under the U.S. Federal Toxic Substances Control Act (TSCA).

3.04 DIVISION 3 - CONCRETE

A. Section 03 3000 - Cast-in-Place Concrete: Replacement of Portland cement, to some extent, with recycled content.

B. Section 03 4100 - Precast Structural Concrete: Replacement of Portland cement, to some extent, with recycled content.

3.05 DIVISION 5 - METALS

A. Section 05 5000 - Metal Fabrications: Custom-fabricated recessed mat frames at regularly used exterior entrances.

B. Section 05 5305 - Metal Gratings and Floor Plates: Custom-fabricated metal gratings at regularly used exterior entrances.

3.06 DIVISION 6 - WOOD, PLASTICS, AND COMPOSITES

A. Note: Definition of sustainably harvested wood is in Section 01 6000.

B. Section 06 1000 - Rough Carpentry: Requirement to use sustainably harvested wood.

C. Section 06 1323 - Heavy Timber Framing: Requirement to use sustainably harvested wood.

D. Section 06 1326 - Heavy Timber Trusses: Requirement to use sustainably harvested wood.

E. Section 06 1500 - Wood Decking: Requirement to use sustainably harvested wood.

F. Section 06 1736 - Metal-Web Wood Joists: Requirement to use sustainably harvested wood.

G. Section 06 1753 - Shop-Fabricated Wood Trusses: Requirement to use sustainably harvested wood.

H. Section 06 1800 - Glued-Laminated Construction: Requirement to use sustainably harvested wood.

I. Section 06 2000 - Finish Carpentry: Requirement to use sustainably harvested wood.

J. Section 06 4100 - Architectural Wood Casework: Requirement to use sustainably harvested wood.

3.07 DIVISION 7 - THERMAL AND MOISTURE PROTECTION

A. Section 07 1300 - Sheet Waterproofing: For vegetated roof.

B. Section 07 1400 - Fluid-Applied Waterproofing: For vegetated roof.

C. Section 07 4113 - Metal Roof Panels: Rain water collection surface.

D. Section 07 5200 - Modified Bituminous Membrane Roofing: For vegetated roof.

E. Section 07 5300 - Elastomeric Membrane Roofing: Unballasted white or light-colored roofing with minimum SRI specified

F. Section 07 5400 - Thermoplastic Membrane Roofing: Unballasted white or light colored roofing with minimum SRI specified.

G. Section 07 5050 - Vegetated Roof Components: Plants, planting modules, fill, and insulation.

H. Section 07 6100 - Sheet Metal Roofing: Rain water collection surface.

I. Section 07 8400 - Firestopping: Emissions-compliant firestopping sealants.

J. Section 07 8400 - Firestopping: Sealing penetrations in walls, floors, and ceilings between residential units.

K. Section 07 9200 - Joint Sealants: Sealing penetrations in walls, floors, and ceilings between residential units.

L. Section 07 9200 - Joint Sealants: Emissions-compliant sealants.

3.08 DIVISION 8 - OPENINGS

A. Section 08 4313 - Aluminum-Framed Storefronts: For daylighting and views.

B. Section 08 4413 - Glazed Aluminum Curtain Walls: For daylighting and views.

C. Section 08 4418 - Glazed Steel Curtain Walls: For daylighting and views.

D. Section 08 4500 - Translucent Wall and Roof Assemblies: For daylighting and views.

E. Section 08 5113 - Aluminum Windows: For daylighting and views.

F. Section 08 5313 - Vinyl Windows: For daylighting and views.

G. Section 08 5413 - Fiberglass Windows: For daylighting and views.

H. Section 08 6200 - Unit Skylights: For daylighting.

I. Section 08 6223 - Tubular Skylights: For daylighting.

J. Section 08 6300 - Metal-Framed Skylights: For daylighting.

K. Section 08 7100 - Door Hardware: Door closers at rooms where hazardous gases or chemicals are present or used.

L. Section 08 8000 - Glazing: For daylighting and views.

3.09 DIVISION 9 - FINISHES

A. Section 09 2116 - Gypsum Board Assemblies: Deck-to-deck sealed partitions around rooms where hazardous gases or chemicals are present or used.

B. Section 09 6813 - Tile Carpeting: Carpet tile complying with CRI Green Label Plus requirements.

C. Section 09 6816 - Sheet Carpeting: Carpet complying with CRI Green Label Plus requirements.

D. Section 09 9123 - Interior Painting: Emissions-compliant interior opaque paints and coatings.

E. Section 09 9600 - High-Performance Coatings: Emissions-compliant interior opaque high performance coatings.

3.10 DIVISION 10 - SPECIALTIES

A. Section 10 1400 - Signage:

1. Signs identifying preferred parking spaces for green vehicles.

2. Signage at parking entrances stating discounted rate for green vehicles.

B. Section 10 5100 - Lockers: Lockers near bicycle entrance; metal.

C. Section 10 7113.43 - Fixed Sun Screens.

3.11 DIVISION 11 - EQUIPMENT

A. Section 11 4000 - Foodservice Equipment: Energy Star rated appliances.

B. Section [_____] - Solid Waste Bins: Recycling storage containers.

C. Section [_____] - Electric Vehicle Charging Stations.

3.12 DIVISION 12 - FURNISHINGS

A. Section 12 2400 - Window Shades: Motorized window shades.

B. Section 12 3600 - Countertops: Requirement to use sustainably harvested wood.

C. Section 12 4813 - Entrance Floor Mats and Frames: Manufactured recessed floor grilles at high volume entryways.

D. Section 12 9313 - Bicycle Racks.

E. Section 12 9314 - Bicycle Lockers.

3.13 DIVISION 21 - FIRE SUPPRESSION

A. Section 21 2200 - Clean-Agent Fire-Extinguishing System: Non-water based fire suppression equipment using extinguishing agent other than Halon.

3.14 DIVISION 22 - PLUMBING

A. Building-level water meter is provided by the local utility.

B. Section 22 0519 - Meters and Gauges for Plumbing Piping: Plumbing metering devices for water subsystems.

C. Section 22 1005 - Plumbing Piping: Potable and non-potable water distribution.

1. Documentation of products meeting regulatory lead-content restrictions.
2. Certification of proper soldering of copper piping joints.
3. Above-grade copper piping is to have mechanically crimped joints.

D. Section 22 1006 - Plumbing Piping Specialties: Specialties for potable and non-potable water distribution.

1. Documentation of products meeting regulatory lead-content restrictions.

E. Section 22 3000 - Plumbing Equipment: Plumbing pumps for non-potable water distribution.

F. Section 22 4000 - Plumbing Fixtures:

1. WaterSense-labeled water closets, urinals, lavatory faucets, and showerheads.
2. Documentation of products meeting regulatory lead-content restrictions.
3. Toilets supplied by non-potable water distribution.
4. Replacement plumbing fixtures.

G. Section 22 4300 - Healthcare Plumbing Fixtures:

1. WaterSense-labeled water closets, urinals, lavatory faucets, and showerheads.
2. Documentation of products meeting regulatory lead-content restrictions.

3.15 DIVISION 23 - HVAC

A. Section 23 0800 - Commissioning of HVAC.

B. Section 23 0130.51 - HVAC Air-Distribution System Cleaning: Remedial cleaning in the event Contractor's efforts under Section 01 5719 - Temporary Environmental Controls are insufficient.

C. Section 23 0519 - Meters and Gauges for HVAC Piping.

D. Section 23 0913 - Instrumentation and Control Devices for HVAC:

1. HVAC monitoring and metering devices.
2. For minimum ventilation performance.
3. Outdoor airflow measurement devices in HVAC system.
4. General ventilation control devices.
5. Carbon dioxide monitoring devices for ventilation control.
6. Humidity control devices.

E. Section 23 0923 - Direct-Digital Control System for HVAC:

F. Section 23 0993 - Sequence of Operations for HVAC Controls.

G. Section 23 2300 - Refrigerant Piping: Refrigerant options are limited those with ODP of zero and GWP of less than 50.

H. Section 23 2500 - HVAC Water Treatment: Water treatment to reduce cooling tower water usage.

I. Section 23 3100 - HVAC Ducts and Casings: For mechanical ventilation.

J. Section 23 3100 - HVAC Ducts and Casings: Emissions-compliant duct sealers.

K. Section 23 3423 - HVAC Power Ventilators: Exhaust fans.

L. Section 23 3600 - Air Terminal Units: Locally controlled HVAC terminal units.

M. Section 23 4000 - HVAC Air Cleaning Devices: Air filters.

N. Section 23 5216 - Condensing Boilers: High efficiency boilers.

O. Section 23 6100 - Refrigerant Compressors: Refrigerant options are limited those with ODP of zero and GWP of less than 50.

P. Section 23 6213 - Packaged Air-Cooled Refrigerant Compressor and Condenser Units: Refrigerant options are limited those with ODP of zero and GWP of less than 50.

Q. Section 23 6416 - Centrifugal Water Chillers: Refrigerant options are limited those with ODP of zero and GWP of less than 50.

R. Section 23 7313 - Modular Indoor Central-Station Air-Handling Units: Refrigerant options are limited those with ODP of zero and GWP of less than 50.

S. Section 23 7413 - Packaged Outdoor Central-Station Air-Handling Units: Refrigerant options are limited those with ODP of zero and GWP of less than 50.

T. Section 23 7433 - Dedicated Outdoor Air Units: Refrigerant options are limited those with ODP of zero and GWP of less than 50.

U. Section 23 8113 - Packaged Terminal Air-Conditioners: Refrigerant options are limited those with ODP of zero and GWP of less than 50.

V. Section 23 8119 - Self-Contained Air-Conditioners: Refrigerant options are limited those with ODP of zero and GWP of less than 50.

W. Section 23 8124 - Computer Room Air Conditioners - Floor Mounted: Refrigerant options are limited those with ODP of zero and GWP of less than 50.

X. Section 23 8125 - Computer Room Air Conditioners - Ceiling Mounted: Refrigerant options are limited those with ODP of zero and GWP of less than 50.

Y. Section 23 8126.13 - Small-Capacity Split-System Air Conditioners: Refrigerant options are limited those with ODP of zero and GWP of less than 50.

Z. Section 23 8129 - Variable Refrigerant Flow HVAC Systems: Refrigerant options are limited those with ODP of zero and GWP of less than 50.

AA. Section 23 8149 - Ground-Source Unitary Heat Pumps: For use with ground-loop piping and hydronic distribution system; refrigerant options are limited to those having ODP of zero and GWP of less than 50.

3.16 DIVISION 25 - INTEGRATED AUTOMATION

3.17 DIVISION 26 - ELECTRICAL

A. Section 26 0505 - Selective Demolition for Electrical:

1. Certification of removal and appropriate disposal of abandoned cables containing lead stabilizers.

2. Minor removal and disposal of mercury-containing lamps and PCB- and DEHP-containing ballasts.

B. Section 26 0513 - Medium-Voltage Cables: Wiring meeting lead-content restrictions.

C. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Conductors and cables meeting lead-content restrictions.

D. Section 26 0923 - Lighting Control Devices: Automatic lighting controls.

E. Section 26 1200 - Medium-Voltage Transformers: Replacement transformers.

F. Section 26 2200 - Low-Voltage Transformers: Replacement transformers.

G. Section 26 2713 - Electricity Metering.

H. Section 26 2726 - Wiring Devices: Manual lighting control devices.

I. Section 26 3100 - Photovoltaic Collectors: And related equipment and roof supports.

J. Section 26 5100 - Interior Lighting:

1. Limitations on mercury content of lamps.
2. Minimum rated lamp life.
3. Interior lighting fixtures selected and laid out to minimize light spillover through windows.

K. Section 26 5600 - Exterior Lighting:

1. Limitations on mercury content of lamps.
2. Minimum rated lamp life.
3. Site lighting fixtures that reduce light pollution.

3.18 DIVISION 27 - COMMUNICATIONS

A. Section 27 1000 - Structured Cabling: Limitations on lead content of cable insulation.

3.19 DIVISION 31 - EARTHWORK

A. Note: Temporary erosion and sediment control is located in Division 1.

B. Section 31 1000 - Site Clearing: Fences to protect vegetation not being removed; vegetation removal limits are indicated on drawings; site clearing waste management.

C. Section 31 2200 - Grading.

3.20 DIVISION 32 - EXTERIOR IMPROVEMENTS

A. Section 32 0190 - Operation and Maintenance of Planting: Maintenance contract for first year.

B. Section 32 1125 - Turf Surfaced Roadways.

C. Section 32 1313 - Concrete Paving.

D. Section 32 1413 - Precast Concrete Unit Paving: Open grid concrete unit pavers with gravel fill.

E. Section 32 3300 - Site Furnishings: Benches for places of respite; metal, precast concrete and wood.

F. Section 32 9219 - Seeding.

G. Section 32 9223 - Sodding.

H. Section 32 9300 - Plants: See drawings for specific plant materials.

3.21 DIVISION 33 - UTILITIES

A. Section 33 0513 - Manholes and Structures.

B. Section 33 4211 - Stormwater Gravity Piping.

END OF SECTION

SECTION 01355 - SECURITY PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Security measures including formal security program, entry control, personnel identification, guard service, and miscellaneous restrictions.

1.2 SECURITY PROGRAM

A. Protect Work, existing premises and Owner's operations from theft, vandalism, and unauthorized entry.

B. Initiate program at project mobilization.

C. Maintain program throughout construction period until Owner occupancy.

1.3 ENTRY CONTROL

A. Restrict entrance of persons and vehicles into Project site and existing facilities.

B. Allow entrance only to authorized persons with proper identification.

C. Maintain log of workers and visitors, make available to Owner on request.

D. Coordinate access of Owner's personnel to site in coordination with Owner's security forces.

1.4 PERSONNEL IDENTIFICATION

A. Provide identification badge to each person authorized to enter premises.

B. Badge To Include: Personal photograph, name, assigned number, expiration date and employer.

C. Maintain a list of accredited persons, submit copy to Owner on request.

D. Require return of badges at expiration of their employment on the Work.

1.5 GUARD SERVICE

1.6 RESTRICTIONS

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 3566.05
PROJECT SUSTAINABILITY GOAL CREDIT SUMMARY - LEED V4

PART 1 GENERAL

1.01 PROJECT GOALS

A. This project has been designed to achieve the LEED Certified (minimum 40 points) rating as defined in USGBC LEED v4-BD+C for New Construction.

1. This project is pursuing MR: Building Product Disclosure and Optimization (BPDO) category credit(s) for Environmental Product Declarations, Sourcing of Raw Materials and Materials Ingredients.

a. To achieve Environmental Product Declarations category points, project has targeted successful completion of requirements of Option 1, Environmental Product Declaration path and Option 2, Multi-Attribute Optimization path.

b. To achieve Sourcing of Raw Materials category points, project has targeted successful completion of requirements of Option 1, Raw Material Source and Extraction Reporting path and Option 2, Leadership Extraction Practices path.

c. To achieve Material Ingredients category points, project has targeted successful completion of requirements of Option 1, Material Ingredient Reporting path, Option 2, Material Ingredient Optimization path and Option 3, Product Manufacturer Supply Chain Optimization path.

2. This project is also pursuing EQ: Low-Emitting Materials credit(s) using the Product Category Calculations Method and Budget Calculation Method.

1.02 RELATED REQUIREMENTS

A. Section 013329.02 - Sustainable Design Reporting - LEED v4 for Contractor's reporting responsibilities.

B. Section 01 3566.12 - Sustainability Certification Project Procedures - LEED v4 for Contractor's procedural responsibilities.

1.03 DEFINITIONS

A. Sustainability Rating System: United States Green Building Council's LEED v4 for New Construction.

B. Required: Achievement of this credit is essential for certification of this project.

C. Preferred: Achievement of this credit would be desirable but is not mandatory.

D. Not Required: Achievement of this credit is not expected or not possible for this project.

E. To Be Provided: Provided via one or more construction contracts.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - CREDIT SUMMARY

3.01 SPECIAL PREREQUISITE (FOR HEALTHCARE PROJECTS ONLY)

A. Prerequisite - Required - No points - Integrative project Planning and Design.

1. Design of the project maximizes opportunities for integrated, cost-effective adoption of green design and construction strategies, emphasizing human health as a fundamental evaluative criterion for building design, construction and operational strategies. It utilizes innovative approaches and techniques for green design and construction.

3.02 GENERAL

A. Credit - Undecided - 1 point - Integrative Process.

1. The project has engaged in this process to support high-performance, cost-effective project outcomes through an early analysis of the interrelationships among systems.

3.03 LOCATION AND TRANSPORTATION (LT)

A. LT Credit - Required- New Construction (8 to 16) Points - LEED for Neighborhood Development Location. Projects attempting this credit are not eligible to earn points under other Location and Transportation credits.

1. Project is located within the boundary of a development certified under LEED for Neighborhood Development.

3.04 SUSTAINABLE SITES (SS)

A. SS Prerequisite - Required - No points - Construction Activity Pollution Prevention.

1. During Construction:

a. Preventive measures and remediation are specified in Section 01 5713.

b. Dust control and basic surface drainage are specified in Section 01 7000.

c. Preventive measures prescribed by state law will be followed.

2. Permanent erosion and sedimentation prevention features will be provided:

a. Grading for sediment traps and retention ponds is specified in Section 31 2200.

b. Riprap is specified in Section 31 3700.

c. Turf (for lawns) is specified in Section 32 9219 (seeding).

d. Plants are specified in Section 32 9300.

e. Open grid concrete pavers are specified in Section 32 1413.

B. SS Prerequisite - Required - No points - Environmental Site Assessment - Schools and Healthcare:

1. Site has been assessed for environmental contamination. Environmental contamination remediation is part of this project.

C. SS Credit - Undecided - 1 point - Site Assessment - Building Design and Construction projects.

D. SS Credit - Undecided - 1 to 3 points - Rainwater Management - Building Design and Construction projects.

1. The project reduces runoff volume and improves water quality in a manner that meets the criteria for this Credit.

a. Grading is specified in Section 31 2200.

b. Riprap is specified in Section 31 3700.

c. Plants are specified in Section 32 9300.

E. SS Credit - Undecided - 1 to 2 points - Site Development - Protect or Restore Habitat - Building Design and Construction projects.

F. SS Credit - Undecided - 1 point - Open Space - Building Design and Construction projects.

G. SS Credit - Undecided - 1 to 2 points - Heat Island Reduction - Building Design and Construction projects.

1. The project minimizes effects on microclimates and human and wildlife habitats by reducing heat islands.

a. Option 1 - Combination of measures meeting criteria of the Credit is used to achieve claimed number of points.

1) High-Reflectance Roof - Using roof materials with required minimum solar reflectance index values.

(a) Modified bituminous membrane roofing with cap sheet meeting the requirements is specified in Section 07 5200.

H. SS Credit - Undecided - 1 point - Light Pollution Reduction - Building Design and Construction projects.

1. The project's design increases night sky access, improves nighttime visibility, and reduces the consequences of development for wildlife and people.

a. Light Trespass - Option 1 (BUG Rating Method) - The project meets the criteria for this Credit.

2. Appropriate exterior lighting fixtures are specified in Section 26 5600.

3. Appropriate interior lighting fixtures are specified in Section 26 5100.

4. Lighting control devices for automatic control of lighting are specified in Section 26 0923.

I. SS Credit - Undecided - 1 point - Site Master Plan (for Schools project only).

1. A site master plan for the school has been developed in collaboration with school authorities.

J. SS Credit - Undecided - 1 point - Joint Use of Facilities (for Schools project only).

1. The project integrates the school with the community by sharing the building and its playing fields for nonschool events and functions using one of the options below.

a. Option 1 - Makes building space open to the general public.

3.05 WATER EFFICIENCY (WE)

A. WE Prerequisite - Required - No points - Outdoor Water Use Reduction - Building Design and Construction projects.

B. WE Prerequisite - Required - No points - Indoor Water Use Reduction.

C. WE Prerequisite - Required - No points - Building-Level Water Metering - Building Design and Construction projects.

1. Permanent water meters for potable water are specified in Section 22 0519.

D. WE Prerequisite - Required - No points - Water Metering - Homes Design and Construction projects.

E. WE Credit - Required - 1 to 2 points - Outdoor Water Use Reduction - Building Design and Construction projects.

1. Option 1 - The landscaping does not require irrigation, and no permanent irrigation system is provided beyond a maximum two-year establishment period.

a. The climate provides adequate rainfall for the landscaping intended without need for irrigation.

b. Plants that do not require irrigation are specified in Section 32 9300.

F. WE Credit - Undecided - 1 to 7 Points - Indoor Water Use Reduction.

1. Further reductions in water use have been achieved meeting the criteria for the number of points claimed for this Credit.

2. Appropriate high efficiency and/or waterless fixtures are specified in Section 22 4000.

G. WE Credit - Undecided - 1 point - Water Metering - Building Design and Construction projects.

1. The project includes permanent water metering specified in Section 22 0519 for the following two or more water subsystems:
    a. Indoor plumbing fittings and fixtures are specified in Section 22 4000.
    b. Domestic hot water piping is specified in Section 22 1005.

3.06 ENERGY & ATMOSPHERE (EA)

A. EA Prerequisite - Required - No points - Fundamental Commissioning and Verification.
    1. Requirement for commissioning performed by and under the supervision of an independent commissioning authority is included in the Contract Documents.
    2. Detailed demonstration and training for commissioning is specified in Section 01 7900.
    3. General commissioning criteria are specified in Section 01 9113.
    4. The commissioning authority's responsibilities are specified in Section 01 9114 for Contractor's information only.
    5. Commissioning of HVAC is specified in Section 23 0800.

B. EA Prerequisite - Required - No points - Minimum Energy Performance - Building Design and Construction projects.
    1. Option 2 - Prescriptive Compliance, ASHRAE 50% Advanced Energy Design Guide: Design complies with the mandatory and prescriptive provisions of ANSI/ASHRAE/IESNA Standard 90.1–2010, with errata (or a USGBC-approved equivalent standard for projects outside the U.S.).
    2. The building envelope, HVAC, lighting, etc., have been designed to meet the criteria for this prerequisite.
    3. The overall design solution is implemented in the drawings and many sections of the specifications.

C. EA Prerequisite - Required - No points - Building-Level Energy Metering - Building Design and Construction projects.
    1. Continuous metering systems that meet the credit criteria are to be provided.
        a. Plumbing metering devices are specified in Section 22 0519.
        b. General HVAC monitoring and metering devices are specified in Section 23 0913.

D. EA Prerequisite - Required - No points - Fundamental Refrigerant Management.
    1. New equipment: No CFC-based refrigerants are used in any equipment. Non-CFC refrigerants are specified in the following sections:

E. EA Credit - Undecided - Optimize Energy Performance - Building Design and Construction projects.
    1. Option 2 - 1 to 6 Points - Prescriptive Compliance, ASHRAE Advanced Energy Design Guide: Design meets the criteria for the number of points claimed for this Credit.
    2. The building envelope, HVAC, lighting, etc., have been designed to meet the criteria for the number of points claimed for this Credit.
    3. The overall design solution is implemented in the drawings and many sections of the specifications.

F. EA Credit - Undecided - 1 to 3 points - Renewable Energy Production - Building Design and Construction projects.
    1. Renewable energy systems provide the percentage of the project's total energy cost required for the number of points indicated.

2. The following on-site systems, along with utility net metering, are provided:
    a. Geothermal power generation; specified in Section [_____].

G. EA Credit - Undecided - 2 to 6 points - Enhanced Commissioning - Building Design and Construction projects.
1. Option 1 - Enhanced Systems Commissioning applies to the project.
    a. Path 1 - Enhanced Commissioning compliance path is used.
2. The commissioning authority's responsibilities with regard to design phase review, review of Contractor's submittals, and post-occupancy review are specified in Section 01 9114, which is included for Contractor's information only.

H. EA Credit - Undecided - 1 point - Enhanced Refrigerant Management.
1. Option 2 - Calculation of Refrigerant Impact: The project meets the criteria for this Credit.
2. No Halon is used in any equipment or extinguishing system.

I. EA Credit - Undecided - 1 point - Advanced Energy Metering - Building Design and Construction projects.
1. Continuous advanced energy metering systems that meet the Credit criteria will be provided.
    a. Plumbing metering devices are specified in Section 22 0519.
    b. General HVAC monitoring and metering devices are specified in Section 23 0913.
    c. Lighting, motor, and other electrical load metering devices are specified in Division 26.

3.07 MATERIALS & RESOURCES

A. MR Prerequisite - Required - No points - Storage & Collection of Recyclables.
1. The area designated for collection and storage of recyclables is indicated on the drawings.
2. Bins, waste cans, can crushers, etc., are considered furnishings and are therefore not part of the construction contract.

B. MR Prerequisite - Required - No points - Construction and Demolition Waste Management Planning.
1. Waste diversion goals have been established for the project.

C. MR Credit - Undecided - 2 to 6 points - Building Life-Cycle Impact Reduction.

D. MR Credit - Undecided - 1 to 2 points - Building Product Disclosure and Optimization - Environmental Product Declarations.
1. Option 1 - Environmental Product Declaration (EPD): To achieve Environmental Product Declarations category points, project has targeted successful completion of requirements of this Option.

E. MR Credit - Undecided - 1-2 points - Building Product Disclosure and Optimization - Sourcing of Raw Materials.
1. Option 1 - Raw Material Source and Extraction Reporting: To achieve Sourcing of Raw Materials category points, project has targeted successful completion of requirements of this Option.

F. MR Credit - Undecided - 1 to 2 points - Building Product Disclosure and Optimization - Material Ingredients - Building Design and Construction projects.
1. Option 1 - Material Ingredient Reporting: To achieve Material Ingredients category points, project has targeted successful completion of requirements of this Option.

G. MR Credit - Undecided - Construction and Demolition Waste Management.

1. Option 1 - Diversion.

a. Path 1 - Divert 50 percent of waste, and Three Material Streams - 1 point. The project has targeted achievement of this Credit. It requires the Contractor to meet its criteria, including record-keeping and reporting.

b. Construction procedures and measurement of diverted waste are specified in Section 01 7419. This section requires the Contractor to perform the measurement and computation.

c. Waste prevention and disposal procedures specific to certain types of work are specified in many sections.

3.08 INDOOR ENVIRONMENTAL QUALITY

A. EQ Prerequisite - Required - No points - Minimum Indoor Air Quality (IAQ) Performance - Building Design and Construction projects.

1. Requirements for monitoring of mechanically-ventilated spaces that meet the criteria for this prerequisite are specified in Section 23 0913.

2. The overall design solution is implemented in the drawings and many sections of the specifications.

B. EQ Prerequisite - Required - No points - Environmental Tobacco Smoke (ETS) Control.

1. Owner intends to prohibit smoking in the building.

a. Owner will provide signage indicating no-smoking policy.

C. EQ Prerequisite - Required - No points - Minimum Acoustic Performance (for Schools projects only).

1. Design meets the criteria for this prerequisite.

D. EQ Credit - Undecided - 1 to 2 points - Enhanced Indoor Air Quality (IAQ) Strategies - Building Design and Construction projects.

1. Option 1 - Enhanced IAQ Strategies.

a. Design of the project meets the criteria for these Credits.

b. Entryway Systems:

1) Floor mats and recessed frames are specified in Section 12 4813.

E. EQ Credit - Undecided - 1 point - Construction IAQ Management Plan.

1. Good construction procedures intended to prevent future problems are specified in Section 01 5719.

F. EQ Credit - Undecided - 1 to 3 points - Low-Emitting Materials.

1. Product criteria and reporting criteria for VOC-restricted products are specified in Section 01 6116.

2. Prohibited Content Installer Certification form is included as Section 01 3329.07.

3. Option 1 - Product Category Calculations. The project uses this option to meet the criteria for the claimed number of points for these Credits.

a. Interior paints and coatings applied on site. Calculated by volume.

b. Interior adhesives and sealants applied on site (including flooring adhesive). Calculated by volume

c. Flooring. 100 percent.

d. Composite Wood. 100 percent not covered by other product categories.

e. Healthcare and Schools Projects only: Exterior applied products. Calculated by volume.

4. The following products are used in this project and meet the specified VOC restrictions criteria for this Credit:

a. All adhesives used on the project, whether explicitly specified or not, are considered VOC-restricted products.

b. Composite Wood: Particleboard, plywood, medium density fiberboard (MDF), wheatboard, strawboard, panel substrates, door cores, and laminating adhesives used on-site or in the shop.

1) A project-wide prohibition on use of these products if they contain added urea-formaldehyde is specified.

c. Exterior Applied Products (for Healthcare and Schools projects only); specified in various sections.

1) Hot-mopped asphalt for roofing and coal-tar sealants for parking lots and other paved surfaces are prohibited, and are not specified for the project.

d. Firestopping sealants; specified in Section 07 8400.

e. Architectural joint sealants; specified in Section 07 9200.

f. Carpet; specified in Section 09 6816.

g. Carpet tile; specified in Section 09 6813.

h. Adhesives used in connection with carpet systems.

i. Interior paints and stains are specified in Section 09 9123.

1) Water-based paints or solvent-based paints with VOC content meeting the credit criteria are used for all interior opaque applications.

2) Other coatings, such as stains and clear finishes, are specified to meet the most stringent of federal EPA, state, or local criteria.

j. Duct sealers and sealants; specified in Section 23 3100.

G. EQ Credit - Undecided - 1 point - Thermal Comfort.

1. Thermal Comfort Design.

a. Option 1 - ASHRAE Std 55-2010. The project has been designed to meet criteria for this Credit.

2. HVAC Controls: Controls will be provided for at least 50 percent of individual occupant spaces.

H. EQ Credit - Undecided - 1 to 3 points - Daylight.

1. The project design facilitates daylighting necessary to meet the Credit criteria.

2. Option 3 - Measurement: The project will verify that illuminance levels that meet the criteria for these Credits have been achieved.

I. EQ Credit - Undecided - 1 to 2 points - Quality Views.

1. The project design provides views meeting the Credit criteria.

J. EQ Credit - Undecided - 1 to 2 points - Acoustic Performance.

1. The project design achieves HVAC maximum background noise levels restrictions meeting criteria for these Credits.

2. The project design includes STC class ratings meeting criteria for this Credit as applicable to walls, partitions and floor-ceiling assemblies.

3.09 INNOVATION (IN)

A. IN Credit - Undecided - 1 to 5 points - Innovation.

1. Option 1 - Design of the project achieves significant, measurable environmental performance using a strategy not addressed in the LEED green building rating system.

3.10 REGIONAL PRIORITY (RP)

A. RP Credit - Undecided - 4 points - Region Specific Environmental Priority.

END OF SECTION

SECTION 01 3566.12
SUSTAINABILITY CERTIFICATION PROJECT PROCEDURES - LEED V4

PART 1 GENERAL

1.01 PROJECT APPROACH

A. This project intends to achieve recognition for sustainable design using LEED v4 Certification program.

B. Contractor is not responsible for the application for Sustainability certification, nor for determination of methods of achieving Sustainability credits unless specifically so indicated.

C. Many of the Sustainability credits can be achieved only through intelligent design of the project and are beyond the control of the Contractor. However, certain credits relate to the products and procedures used for construction. Therefore, full cooperation of the Contractor and subcontractors is essential to achieving final certification goal, and they must familiarize themselves with the relevant requirements, and provide the necessary information and instructions to product suppliers and installers.

D. Since Contractor and subcontractors may not be familiar with detailed LEED Sustainability procedures, this section includes a list of other specifications sections that contain related requirements for products and procedures necessary for achievement of targeted Sustainability certification level.

1. Achievement of many prerequisites and credits is dependent on proper performance by Contractor and subcontractors, using specific required project management and work execution means and methods.

2. Achievement of other credits involves quantifying percentages of installed products by weight and cost; these require careful recordkeeping and reporting by the Contractor.

3. See www.usgbc.org for more information.

1.02 RELATED REQUIREMENTS

A. General and Technical Sections: Sections that include requirements intended to achieve Sustainability Credits include, but are not limited to, the following:

B. DIVISION 1 - GENERAL REQUIREMENTS

1. Section 01 1000 - Summary.

2. Section 013329.02 - Sustainable Design Reporting - LEED v4: Requirements and procedures for sustainable design documentation.

3. Section 01 3329.07 - Prohibited Content Installer Certification: Certification by each installer working on project regardless of product type.

4. Section 01 5713 - Temporary Erosion and Sediment Control: Preventive measures and remediation.

5. Section 01 5719 - Temporary Environmental Controls.

a. Basic construction procedures.

b. Contractor's IAQ management plan and construction procedures.

c. Testing of ventilation.

d. Full building flush out before occupancy is required.

e. Air contaminant testing must be performed by Contractor.

f. Air contaminant testing may be substituted for building flush out, at Contractor's option.

6. Section 01 6000 - Product Requirements.

a. Definitions of:
    1) Reused Products.
    2) Recycled Content.
    3) Bio-Based content.
    4) Sustainable forestry certified Wood.
    5) Source Location.
    6) Environmental Product Declarations.
    7) Health Product Declarations.
    8) Cradle-to-Cradle.
    9) GreenScreen Chemical Hazard Analysis.
    10) Manufacturer's Inventory of Product Content.
b. Regionally-sourced products.
    1) Contractor is not required to provide any particular minimum percentage of regionally-sourced products; however, Contractor is required to collect and submit information necessary to determine whether the material is eligible for application of cost multiplier for products sourced within 100 miles (160 Km) of the project site.

7. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: List of indoor-emissions-restricted products and VOC-content-restricted products, requirements, evidence required, and reporting.
8. Section 01 7000 - Execution and Closeout Requirements.
    a. Dust control and basic surface drainage.
    b. Alterations procedures and selective demolition for preserving existing construction.
9. Section 01 7610 - Temporary Protective Coverings: Temporary protection materials to be reused or recycled.
10. Section 01 7419 - Construction Waste Management and Disposal: Requirements for landfill diversion and reporting.
11. Section 01 7800 - Closeout Submittals: Maintenance and operation manuals for commissioned systems.
12. Section 01 7900 - Demonstration and Training.
    a. Demonstration of commissioned systems and equipment.
    b. Training of Owner's personnel.
13. Section 01 9113 - General Commissioning Requirements.
14. Section 01 9114 - Commissioning Authority Responsibilities.
    a. LEED Fundamental Commissioning.
    b. LEED Additional Commissioning.

C. DIVISION 2 - EXISTING CONDITIONS
1. Section 02 4100 - Demolition.
    a. Demolition of existing pavements and other impervious surfacing.

b. Partial demolition for preserving existing construction.

2. Section 02 6500 - Underground Storage Tank Removal
3. Section 02 8213 - Asbestos Abatement
4. Section 02 8400 - Polychlorinate Biphenyl (PCB) Remediation: Abatement of PCBs, mercury, and other substances regulated under the U.S. Federal Toxic Substances Control Act (TSCA).

D. DIVISION 3 - CONCRETE

1. Section 03 3000 - Cast-in-Place Concrete: Replacement of Portland cement, to some extent, with recycled content.
2. Section 03 4100 - Precast Structural Concrete: Replacement of Portland cement, to some extent, with recycled content.
3. Section 03 4500 - Precast Architectural Concrete: Replacement of Portland cement, to some extent, with recycled content.
4. Section 03 4713 - Tilt-Up Concrete: Replacement of Portland cement, to some extent, with recycled content.

E. DIVISION 5 - METALS

1. Section 05 5000 - Metal Fabrications: Custom-fabricated recessed mat frames at regularly used exterior entrances.
2. Section 05 5305: Manufactured foot grilles at regularly used exterior entrances.
3. Section 05 5305 - Metal Gratings and Floor Plates: Custom-fabricated metal gratings at regularly used exterior entrances.

F. DIVISION 6 - WOOD, PLASTICS, AND COMPOSITES

1. Section 06 1000 - Rough Carpentry: Requirement to use sustainable forestry certified wood.
2. Section 06 1323 - Heavy Timber Framing: Requirement to use sustainable forestry certified wood.
3. Section 06 1326 - Heavy Timber Trusses: Requirement to use sustainable forestry certified wood.
4. Section 06 1500 - Wood Decking: Requirement to use sustainable forestry certified wood.
5. Section 06 1733 - Wood I-Joists: Requirement to use sustainable forestry certified wood.
6. Section 06 1736 - Metal-Web Wood Joists: Requirement to use sustainable forestry certified wood.
7. Section 06 1753 - Shop-Fabricated Wood Trusses: Requirement to use sustainable forestry certified wood.
8. Section 06 1800 - Glued-Laminated Construction: Requirement to use sustainable forestry certified wood.
9. Section 06 2000 - Finish Carpentry: Requirement to use sustainable forestry certified wood.
10. Section 06 4100 - Architectural Wood Casework: Requirement to use sustainable forestry certified wood.
11. Section 06 4200 - Wood Paneling: Requirement to use sustainable forestry certified wood.

G. DIVISION 7 - THERMAL AND MOISTURE PROTECTION

1. Section 07 1300 - Sheet Waterproofing: For vegetated roof.
2. Section 07 1400 - Fluid-Applied Waterproofing: For vegetated roof.

3. Section 07 2100 - Thermal Insulation.
    a. Insulation in exterior walls.
    b. Acoustical insulation.
4. Section 07 2400 - Exterior Insulation and Finish Systems: Water-managed systems.
5. Section 07 2500 - Weather Barriers.
    a. Continuous air barriers.
    b. Vapor retarders installed as per energy code requirements.
6. Section 07 4113 - Metal Roof Panels: Rain water collection surface.
7. Section 07 5100 - Built-Up Bituminous Roofing: Unballasted white or light-colored roofing with minimum SRI specified.
8. Section 07 5200 - Modified Bituminous Membrane Roofing.
    a. Unballasted white or light-colored roofing with minimum SRI specified:
    b. For vegetated roof.
9. Section 07 5300 - Elastomeric Membrane Roofing.
    a. Unballasted white or light-colored roofing with minimum SRI specified:
    b. For vegetated roof.
10. Section 07 5400 - Thermoplastic Membrane Roofing.
    a. Unballasted white or light-colored roofing with minimum SRI specified.
    b. For vegetated roof.
11. Section 07 5050 - Vegetated Roof Components: Plants, planting modules, fill, and insulation.
12. Section 07 6100 - Sheet Metal Roofing.
    a. Rain water collection surface.
    b. Lead-free metals.
13. Section 07 6200 - Sheet Metal Flashing and Trim: Lead-free flashing.
14. Section 07 7100 - Roof Specialties.
    a. Lead-free metals.
    b. Downspouts directed into planted area or other landscape features.
    c. Downspouts directed to rainwater harvesting tanks or cisterns.
15. Section 07 7123 - Manufactured Gutters and Downspouts.
    a. Lead-free metals.
    b. Downspouts directed into planted area or other landscape features.
    c. Downspouts directed to rainwater harvesting tanks or cisterns.
16. Section 07 8400 - Firestopping.
    a. Emissions-compliant firestopping sealants.
    b. Sealing penetrations in walls, floors, and ceilings between residential units.
17. Section 07 9200 - Joint Sealants.

a. Emissions-compliant sealants.

b. Sealing penetrations in walls, floors, and ceilings between residential units.

H. DIVISION 8 - OPENINGS

1. Section 08 1416 - Flush Wood Doors: For sustainable forestry certified wood.
2. Section 08 1423 - Clad Wood Doors: For sustainable forestry certified wood.
3. Section 08 3613 - Sectional Doors: For sustainable forestry certified wood.
4. Section 08 4313 - Aluminum-Framed Storefronts: For daylighting and views.
5. Section 08 4413 - Glazed Aluminum Curtain Walls: For daylighting and views.
6. Section 08 4500 - Translucent Wall and Roof Assemblies: For daylighting.
7. Section 08 5113 - Aluminum Windows.
   a. For maximized home energy performance.
   b. For daylighting and views.
8. Section 08 5123 - Steel Windows: For daylighting and views.
9. Section 08 5200 - Wood Windows.
   a. For maximized home energy performance.
   b. For daylighting, views and sustainable forestry certified wood.
10. Section 08 5313 - Vinyl Windows.
    a. For maximized home energy performance.
    b. For daylighting and views.
11. Section 08 5400 - Composite Windows.
    a. For maximized home energy performance.
    b. For daylighting, views and sustainable forestry certified wood.
12. Section 08 7100 - Door Hardware.
13. Section 08 8000 - Glazing: For daylighting and views.

I. DIVISION 9 - FINISHES

1. Section 09 2116 - Gypsum Board Assemblies: Deck-to-deck sealed partitions around rooms where hazardous gases or chemicals are present or used.
2. Section 09 5100 - Acoustical Ceilings: Low-Emitting Materials.
3. Section 09 6229 - Cork Flooring: Flooring made of bio-based or sustainable forestry certified material.
   a. VOC-restrictions for adhesives.
4. Section 09 6500 - Resilient Flooring: VOC restrictions.
5. Section 09 6566 - Resilient Athletic Flooring: VOC restrictions.
6. Section 09 6700 - Fluid-Applied Flooring: VOC restrictions.
7. Section 09 6813 - Tile Carpeting: Carpet tile complying with CRI Green Label Plus requirements.
8. Section 09 6816 - Sheet Carpeting: Carpet complying with CRI Green Label Plus requirements.

9. Section 09 6900 - Access Flooring.
    a. Systems facilitating future project space flexibility, ease of adaptive use,
10. Section 09 7200 - Wall Coverings: Emissions-compliant Wall Coverings;.
11. Section 09 9113 - Exterior Painting.
    a. Lead-free exterior paint.
    b. Exterior paint with no intentionally added cadmium.
12. Section 09 9123 - Interior Painting: Emissions-compliant interior opaque paints and coatings.
    a. Lead-free interior paint.
    b. Interior paint with no intentionally added cadmium.
13. Section 09 9600 - High-Performance Coatings: Emissions-compliant interior opaque high performance coatings.

J. DIVISION 10 - SPECIALTIES
1. Section 10 1400 - Signage.
    a. "No Smoking" signs, and signs identifying designated outdoor smoking areas.
    b. Signs identifying preferred parking spaces for green vehicles.
    c. Signs identifying preferred parking spaces for car-van pooling vehicles.
    d. Signage at parking entrances stating discounted rate for green vehicles.
    e. Signage for areas of respite.
2. Section 10 2219 - Demountable Partitions.
    a. Systems facilitating future project space flexibility, ease of adaptive use,
3. Section 10 5100 - Lockers: Lockers near bicycle entrance; metal.
4. Section 10 7113.43 - Fixed Sun Screens.

K. DIVISION 11 - EQUIPMENT
1. Section 11 4000 - Foodservice Equipment: Energy Star rated appliances.
2. Section 11 5300 - Laboratory Equipment.
    a. Indoor water-use-reducing equipment.
3. Section 12 2400 - Interior Automatic Shading Devices:
    a. For glare control.
4. Section 11 8226 - Facility Waste Compactors: For recycling.
5. DIVISION 12 - FURNISHINGS
6. Section 12 2400 - Window Shades: Motorized window shades.
7. Section 12 3100 - Manufactured Metal Casework.
    a. Systems facilitating future project space flexibility, ease of adaptive use.
8. Section 12 3200 - Manufactured Wood Casework.
    a. Sustainable forestry certified wood.
    b. Systems facilitating future project space flexibility, ease of adaptive use.

9. Section 12 3553.13 - Metal Laboratory Casework.
10. Section 12 3600 - Countertops: Requirement to use sustainable forestry certified wood.
11. Section 12 4813 - Entrance Floor Mats and Frames: Manufactured recessed floor grilles at high volume entryways.

L. DIVISION 13 - SPECIAL CONSTRUCTION

1. Section 13 3100 - Fabric Structures: Shade structures for heat island reduction.

M. DIVISION 21 - FIRE SUPPRESSION

1. Section 21 2200 - Clean-Agent Fire-Extinguishing System: Non-water based fire suppression equipment using extinguishing agent other than Halon.

N. DIVISION 22 - PLUMBING

1. Building-level water meter is provided by the local utility.
2. Section 22 0519 - Meters and Gauges for Plumbing Piping: Plumbing metering devices for water subsystems.
3. Section 22 0719 - Plumbing Piping Insulation: Domestic hot water piping insulation.
4. Section 22 1005 - Plumbing Piping: Potable and non-potable water distribution.
    a. Documentation of products meeting regulatory lead-content restrictions.
    b. Certification of proper soldering of copper piping joints.
    c. Above-grade copper piping is to have mechanically crimped joints.
5. Section 22 1006 - Plumbing Piping Specialties: Specialties for potable and non-potable water distribution.
    a. Documentation of products meeting regulatory lead-content restrictions.
6. Section 22 3000 - Plumbing Equipment:
    a. Plumbing pumps for non-potable water distribution.
    b. Efficient domestic hot water equipment.
7. Section 22 4000 - Plumbing Fixtures.
    a. WaterSense-labeled water closets, urinals, lavatory faucets, and showerheads.
    b. Documentation of products meeting regulatory lead-content restrictions.
    c. Toilets supplied by non-potable water distribution.
    d. Showers near bicycle entrance.
    e. Replacement plumbing fixtures.
    f. High efficiency and dry toilet fixtures; occupant sensors.

O. DIVISION 23 - HVAC

1. Section 23 0130: Refrigerant recycling and recovery; replacement of CFC and HCFC refrigerants in existing equipment.
2. Section 23 0130.51 - HVAC Air-Distribution System Cleaning: Remedial cleaning in the event Contractor's efforts under Section 01 5719 - Temporary Environmental Controls are insufficient.
3. Section 23 0519 - Meters and Gauges for HVAC Piping.

4. Section 23 0593 - Testing, Adjusting, and Balancing for HVAC.
5. Section 23 0800 - Commissioning of HVAC.
6. Section 23 0913 - Instrumentation and Control Devices for HVAC.
    a. HVAC monitoring and metering devices.
    b. For minimum ventilation performance.
    c. Outdoor airflow measurement devices in HVAC system.
    d. General ventilation control devices.
    e. Carbon dioxide monitoring/sensor devices.
    f. Humidity control devices.
7. Section 23 0923 - Direct-Digital Control System for HVAC.
8. Section 23 0943 - Pneumatic Control System for HVAC.
9. Section 23 0993 - Sequence of Operations for HVAC Controls.
10. Section 23 2113 - Hydronic Piping: Connection to non-potable water distribution.
11. Section 23 2113.33 - Ground-Loop Heat-Pump Piping: Connection to non-potable water distribution.
12. Section 23 2114 - Hydronic Specialties: Radiator valves
13. Section 23 2300 - Refrigerant Piping: Refrigerant options are limited those with ODP of zero and GWP of less than 50.
14. Section 23 2500 - HVAC Water Treatment: Water treatment to reduce cooling tower water usage.
15. Section 23 3100 - HVAC Ducts and Casings: For mechanical ventilation.
16. Section 23 3100 - HVAC Ducts and Casings: Emissions-compliant duct sealers.
17. Section 23 3423 - HVAC Power Ventilators: Exhaust fans.
18. Section 23 3600 - Air Terminal Units: Locally controlled HVAC terminal units.
19. Section 23 4000 - HVAC Air Cleaning Devices: Air filters.
20. Section 23 5216: Boilers incorporating required water conservation features.
21. Section 23 5400 - Furnaces: Furnaces for residential construction.
22. Section 23 5613.13 - Heating Solar Flat-Plate Collectors.
23. Section 23 6100 - Refrigerant Compressors: Refrigerant options are limited those with ODP of zero and GWP of less than 50.
    a. Non-CFC refrigerant.
24. Section 23 6213 - Packaged Air-Cooled Refrigerant Compressor and Condenser Units: Refrigerant options are limited those with ODP of zero and GWP of less than 50.
    a. Non-CFC refrigerant.
25. Section 23 6313 - Air Cooled Refrigerant Condensers: Refrigerant options are limited those with ODP of zero and GWP of less than 50.
    a. Non-CFC refrigerant.
26. Section 23 7333: Central air conditioning systems.
27. 23 6423 - Water Cooled Chillers

28. 23 6513 - Closed Circuit Cooling Towers
29. 23 6514 - Induced Draft Cooling Towers
30. Section 23 7313 - Modular Indoor Central-Station Air-Handling Units: Refrigerant options are limited those with ODP of zero and GWP of less than 50.
31. Section 23 7413 - Packaged Outdoor Central-Station Air-Handling Units: Refrigerant options are limited those with ODP of zero and GWP of less than 50.
32. Section 23 7433 - Dedicated Outdoor Air Units: Refrigerant options are limited those with ODP of zero and GWP of less than 50.
33. Section 23 8126.13 - Small-Capacity Split-System Air Conditioners: Refrigerant options are limited those with ODP of zero and GWP of less than 50.
34. Section 23 8129 - Variable Refrigerant Flow HVAC Systems: Refrigerant options are limited those with ODP of zero and GWP of less than 50.
35. Section 23 8149 - Ground-Source Unitary Heat Pumps: For use with ground-loop piping and hydronic distribution system; refrigerant options are limited to those having ODP of zero and GWP of less than 50.
36. Section 23 8200 - Convection Heating and Cooling Units. Radiators.

P. DIVISION 26 - ELECTRICAL

1. Section 26 0505 - Selective Demolition for Electrical.
    a. Certification of removal and appropriate disposal of abandoned cables containing lead stabilizers.
2. Section 26 0513 - Medium-Voltage Cables: Wiring meeting lead-content restrictions.
3. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Conductors and cables meeting lead-content restrictions.
4. Section 26 0918 - Remote Control Switching Devices.
5. Section 26 0923 - Lighting Control Devices: Automatic lighting controls.
6. Section 26 1200 - Medium-Voltage Transformers: Replacement transformers.
7. Section 26 2200 - Low-Voltage Transformers: Replacement transformers.
8. Section 26 2713 - Electricity Metering.
9. Section 26 2726 - Wiring Devices: Manual lighting control devices.
10. Section 26 5100 - Interior Lighting.
    a. Limitations on mercury content of lamps.
    b. Minimum rated lamp life.
    c. Replacement ballasts for existing fixtures.
    d. Interior lighting fixtures selected and laid out to minimize light spillover through windows.
11. Section 26 5600 - Exterior Lighting.
    a. Limitations on mercury content of lamps.
    b. Minimum rated lamp life.
    c. Site lighting fixtures that reduce light pollution.

Q. DIVISION 27 - COMMUNICATIONS

1. Section 27 1000 - Structured Cabling: Limitations on lead content of cable insulation.
2. Section 27 5119 - Sound Masking Systems: Systems for acoustic comfort design in open office areas.

R. DIVISION 31 - EARTHWORK

1. Note: Temporary erosion and sediment control is located in Division 1.
2. Section 31 1000 - Site Clearing: Fences to protect vegetation not being removed; vegetation removal limits are indicated on drawings; site clearing waste management.
3. Section 31 2200 - Grading.
4. Section 31 3700 - Riprap.

S. DIVISION 32 - EXTERIOR IMPROVEMENTS

1. Section 32 0190 - Operation and Maintenance of Planting: Maintenance contract for 90 days.
2. Section 32 1125 - Turf Surfaced Roadways.
3. Section 32 1313 - Concrete Paving.
4. Section 32 1413 - Precast Concrete Unit Paving: Open grid concrete unit pavers with gravel fill.
5. Section 32 1723.13 - Painted Pavement Markings: Marking of dedicated bicycle lanes.
6. Section 32 3300 - Site Furnishings: Benches for places of respite; metal, precast concrete and wood.
7. Section 32 8423 - Underground Sprinklers: Sprinkler system supplied by non-potable water system.
8. Section 32 9219 - Seeding.
9. Section 32 9223 - Sodding.
10. Section 32 9300 - Plants: See drawings for specific plant materials.

T. DIVISION 33 - UTILITIES

1. Section 33 0513 - Manholes and Structures.
2. Section 33 4211 - Stormwater Gravity Piping.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for additional submittal procedures requirements.

1.04 INFORMATION SOURCES

A. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE); 1791 Tullie Circle, NE, Atlanta, GA 30329. Tel: (404) 636-8400. Fax: (404) 321-5478. www.ashrae.org.

B. Green Seal; 1001 Connecticut Avenue, NW, Suite 827, Washington, DC 20036-5525. Tel: (202) 872-6400. Fax: (202) 872-4324. www.greenseal.org.

C. U.S. Green Building Council (USGBC); 1015 18th Street, NW, Suite 805, Washington, DC 20036. Tel: (202) 82-USGBC or (202) 828-7422. Fax: (202) 828-5110. www.usgbc.org.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PROCEDURES

A. General: Conduct project management and construction operations in a manner consistent with, and in support of successful achievement of Owner's targeted certification level.

B. Construction Waste Management and Disposal: Implement approved waste management plan during the entire duration of the Contract.

C. Commissioning Authority Activities: Cooperate with Commissioning Authority to coordinate construction and closeout activities scheduling.

D. Sustainable Design Reporting: Comply with requirements of Section 013329.02.

3.02 SMOKING POLICY

A. General: Smoking policy on the project site is implemented for the following reasons:

B. Smoking is not permitted anywhere on project site.

3.03 CONSTRUCTION WASTE MANAGEMENT

A. Comply with applicable requirements of Section 01 7419 - Construction Waste Management and Disposal.

3.04 TEMPORARY ENVIRONMENTAL CONTROLS

A. Comply with applicable requirements of Section 01 5719 - Temporary Environmental Controls.

END OF SECTION

SECTION 01 4000
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.

B. Quality assurance.

C. References and standards.

D. Inspection agencies and services.

E. Contractor's construction-related professional design services.

F. Contractor's design-related professional design services.

G. Control of installation.

H. Mock-ups.

I. Tolerances.

J. Manufacturers' field services.

K. Defect Assessment.

1.02 RELATED REQUIREMENTS

A. Document 00 3100 - Available Project Information: Soil investigation data.

B. Document 00 7200 - General Conditions: Inspections and approvals required by public authorities.

C. Section 01 2100 - Allowances: Allowance for payment of testing services.

D. Section 01 3000 - Administrative Requirements: Submittal procedures.

E. Section 01 4216 - Definitions.

F. Section 01 4219 - Reference Standards.

G. Section 01 6000 - Product Requirements: Requirements for material and product quality.

1.03 REFERENCE STANDARDS

A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants 2008 (Reapproved 2014).

B. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation 2017.

C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry 2015a, with Editorial Revision (2016).

D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction 2012a.

E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection 2018.

F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing 2015.

G. ASTM E699 - Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components 2016.

H. IAS AC89 - Accreditation Criteria for Testing Laboratories 2017.

1.04 DEFINITIONS

A. Contractor's Quality Control Plan: Contractor's management plan for executing the Contract for Construction.

B. Contractor's Professional Design Services: Design of some aspect or portion of the project by party other than the design professional of record. Provide these services as part of the Contract for Construction.

1. Design Services Types Required:

a. Construction-Related: Services Contractor needs to provide in order to carry out the Contractor’s sole responsibilities for construction means, methods, techniques, sequences, and procedures.

b. Design-Related: Design services explicitly required to be performed by another design professional due to highly-technical and/or specialized nature of a portion of the project. Services primarily involve engineering analysis, calculations, and design, and are not intended to alter the aesthetic aspects of the design.

C. Design Data: Design-related, signed and sealed drawings, calculations, specifications, certifications, shop drawings and other submittals provided by Contractor, and prepared directly by, or under direct supervision of, appropriately licensed design professional.

1.05 CONTRACTOR'S CONSTRUCTION-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

B. Provide such engineering design services as may be necessary to plan and safely conduct certain construction operations, pertaining to, but not limited to the following:

1. Temporary sheeting, shoring, or supports.

2. Temporary scaffolding.

3. Temporary bracing.

4. Temporary stairs or steps required for construction access only.

5. Temporary hoist(s) and rigging.

6. Investigation of soil conditions to support construction equipment.

1.06 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

B. Base design on performance and/or design criteria indicated in individual specification sections.

1. Submit a Request for Interpretation to Architect if the criteria indicated are not sufficient to perform required design services.

C. Scope of Contractor's Professional Design Services: Provide for the following items of work:

1. Structural Design of Reinforcement Splices: As described in Section 03 0100 - Maintenance of Concrete.

2. Structural Design of Formwork: As described in Section 03 1000 - Concrete Forming and Accessories.

3. Structural Design of Formwork: As described in Section 03 1119 - Insulating Concrete Forming.

4. Concrete Mix Design: As described in Section 03 3000 - Cast-in-Place Concrete. No specific designer qualifications are required.

5. Structural Calculations and Design: As described in Section 03 3800 - Post-Tensioned Concrete.
6. Structural Calculations and Design: As described in Section 03 4100 - Precast Structural Concrete.
7. Concrete Mix and Structural Design: As described in Section 03 4113 - Precast Concrete Hollow Core Planks.
8. Concrete Mix and Structural Design: As described in Section 03 4500 - Precast Architectural Concrete.
9. Structural Design of Steel Connections: As described in Section 05 1200 - Structural Steel Framing.
10. Structural Design of Steel Connections: As described in Section 05 2100 - Steel Joist Framing.
11. Structural Design of Steel Decking: As described in Section 05 3100 - Steel Decking.
12. Structural Design of Steel Trusses: As described in Section 05 4400 - Cold-Formed Steel Trusses.
13. Structural Design of Formwork: As described in Section 05 4500 - Metal Support Assemblies.
14. Structural Design of Metal Fabrications: As described in Section 05 5000 - Metal Fabrications.
15. Structural Design of Stairs: As described in Section 05 5100 - Metal Stairs.
16. Structural Design of Gratings and Plates: As described in Section 05 5305 - Metal Gratings and Floor Plates.
17. Structural Design of Spiral Stairs: As described in Section 05 7113 - Fabricated Metal Spiral Stairs.
18. Structural Design of Insulated Panels: As described in Section 06 1219 - Structural Insulated Panels.
19. Structural Design of Heavy Timber Framing: As described in Section 06 1323 - Heavy Timber Framing.
20. Structural Design of Wood Decking: As described in Section 06 1500 - Wood Decking.
21. Structural Design of Metal-Web Wood Joists: As described in Section 06 1736 - Metal-Web Wood Joists.
22. Structural Design of Wood Trusses: As described in Section 06 1753 - Shop-Fabricated Wood Trusses
23. Structural Design of Glued-Laminated Construction: As described in Section 06 1800 - Glued-Laminated Construction.
24. Structural Design of Fabrications: As described in Section 06 8200 - Composite Trim.
25. Structural Calculations: As described in Section 07 4213.23 - Metal Composite Material Wall Panels.
26. Fire Protection Design: As described in Section 07 8700 - Smoke Containment Barriers.
27. Structural Design: Include physical characteristics, engineering calculations, and resulting dimensional limitations as described in Section 08 4435 - Protective Framed Glazing Assemblies.
28. Structural Design Calculations for Exterior Assemblies: As described in Section 08 4126 - All-Glass Entrances and Storefronts.
29. Structural Design: Include physical characteristics, engineering calculations, and resulting dimensional limitations as described in Section 08 4313 - Aluminum-Framed Storefronts.
30. Structural design: Include calculations for resisting wind loads, anchor locations, and loads at points of attachment as described in Section 08 4327 - Channel Glass Storefronts.

31. Structural Design: Include calculations for resisting wind loads, anchor locations, loads at points of attachment to building structure, physical characteristics, resulting dimensional limitations as described in Section 08 4413 - Glazed Aluminum Curtain Walls.
32. Structural Design: Include calculations for resisting wind loads, anchor locations, loads at points of attachment to building structure, physical characteristics, resulting dimensional limitations as described in Section 08 4418 - Glazed Steel Curtain Walls.
33. Structural Design: Include calculations for resisting wind loads, physical characteristics, resulting dimensional limitations as described in Section 08 4500 - Translucent Wall and Roof Assemblies.
34. Structural Design of Floor System: As described in Section 09 6900 - Access Flooring.
35. Structural Design and Calculations: As described in Section 10 7113.43 - Fixed Sun Screens.
36. Structural Design of Canopy: As described in Section 10 7316.13 - Metal Canopies.
37. Structural Design of Foundation: As described in Section 10 7500 - Flagpoles.
38. Structural Design and Calculations: As described in Section 10 8200 - Grilles and Screens.
39. Control System Design. As described in Section 11 1400 - Pedestrian Control Equipment.
40. Structural Design of Pool Tank Supports: As described in Section 13 1100 - Swimming Pools.
41. Structural Design of Cold Storage Room Roof: As described in Section 13 2126 - Cold Storage Rooms
42. Design of Structural Components: Include development of shop drawings, and performing shop and site work, as described in Section 13 3419 - Metal Building Systems.
43. Corrosion Protection Design: As described in Section 13 4713 - Cathodic Protection.
44. Design of Structural Components: As described in Section 14 2020 - Freight Elevators.
45. Design of Structural Components: As described in Section 14 2100 - Electric Traction Elevators.
46. Design of Structural Components: As described in Section 14 2400 - Hydraulic Elevators.
47. Sprinkler Layout: Coordinate with ceiling installation, detailed pipe layout, and hydraulic calculations as described in Section 21 1300 - Fire-Suppression Sprinkler Systems.
48. System Design: Include calculations, detailed layout, component locations, control diagrams, wiring diagrams, and sequences of operation as described in Section 21 2400 - Dry-Chemical Fire-Extinguishing System.
49. System Design and Detailed Layout: As described in Section 21 3000 - Fire Pumps.
50. Structural Design of Seismic Controls: As described in Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.
51. System Design: As described in Section 23 0923 - Direct-Digital Control System for HVAC.
52. Written Sequence of Operation: Include entire HVAC system and each piece of equipment, as described in Section 23 0993 - Sequence of Operations for HVAC Controls.
53. Piping System Design: As described in Section 23 2300 - Refrigerant Piping.
54. Engineering Calculations Indicating Maximum Room Sound Levels Are Not Exceeded: As described in Section 23 3319 - Duct Silencers.
55. Structural Calculations and Design of Equipment Mounting: As described in Section 26 3100 - Photovoltaic Collectors.
56. Sound Masking Systems Design: As described in Section 27 5119 - Sound Masking Systems.

57. Monitoring of Pile Placement, Elevation, and Load Testing: As described in Section 31 0916.21 - Pile Load Tests.
58. Design of Structural Fill: As described in Section 31 2323 - Fill.
59. Selection and Design of Pile Components: As described in Section 31 6213.19 - Precast Concrete Piles
60. Selection and Design of Pile Components: As described in Section 31 6216.16 - Steel H Piles.
61. Selection and Design of Pile Components: As described in Section 31 6219 - Timber Piles.
62. Design of Piles: As described in Section 31 6316 - Auger Cast Grout Piles.
63. Design of Piers: As described in Section 31 6329 - Drilled Concrete Piers and Shafts
64. Design or Piers: As described in Section 31 6614 - Hydraulically Driven Pier Foundations.
65. Structural Calculations and Design: As described in Section 32 3223 - Segmental Retaining Walls
66. Design of Seismic Component of Structural Supports and Anchors: As described in Section 46 0509 - Piping and Equipment Supports and Anchors.

1.07 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Designer's Qualification Statement: Submit for Architect's knowledge as contract administrator, or for Owner's information.

1. Include information for each individual professional responsible for producing, or supervising production of, design-related professional services provided by Contractor.
    a. Full name.
    b. Professional licensure information.
    c. Statement addressing extent and depth of experience specifically relevant to design of items assigned to Contractor.

C. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the contract documents, or for Owner's information.

1. Include calculations that have been used to demonstrate compliance to performance and regulatory criteria provided, and to determine design solutions.
2. Include required product data and shop drawings.
3. Include a statement or certification attesting that design data complies with criteria indicated, such as building codes, loads, functional, and similar engineering requirements.
4. Include signature and seal of design professional responsible for allocated design services on calculations and drawings.

D. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.

1. Include:
    a. Date issued.
    b. Project title and number.
    c. Name of inspector.

d. Date and time of sampling or inspection.

e. Identification of product and specifications section.

f. Location in the Project.

g. Type of test/inspection.

h. Date of test/inspection.

i. Results of test/inspection.

j. Compliance with Contract Documents.

k. When requested by Architect , provide interpretation of results.

2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the contract documents, or for Owner's information.

E. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.

1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect .

F. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

G. Manufacturer's Field Reports: Submit reports for Architect 's benefit as contract administrator or for Owner .

1. Submit report in duplicate within 30 days of observation to Architect for information.

2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the contract documents.

1.08 QUALITY ASSURANCE

A. Testing Agency Qualifications:

1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.

2. Qualification Statement: Provide documentation showing testing laboratory is accredited under IAS AC89.

B. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in Maryland.

C. Contractor's Quality Control (CQC) Plan:

1. Prior to start of work, submit a comprehensive plan describing how contract deliverables will be produced. Tailor CQC plan to specific requirements of the project. Include the following information:

a. Management Structure: Identify personnel responsible for quality. Include a chart showing lines of authority.

1) Include qualifications (in resume form), duties, responsibilities of each person assigned to CQC function.

b. Management Approach: Define, describe, and include in the plan specific methodologies used in executing the work.

1) Management and control of documents and records relating to quality.

2) Communications.

3) Coordination procedures.

4) Resource management.

5) Process control.

6) Inspection and testing procedures and scheduling.

7) Control of noncomplying work.

8) Tracking deficiencies from identification, through acceptable corrective action, and verification.

9) Control of testing and measuring equipment.

10) Project materials certification.

11) Managerial continuity and flexibility.

c. Owner will not make a separate payment for providing and maintaining a Quality Control Plan. Include associated costs in Bid price.

d. Acceptance of the plan is required prior to start of construction activities not including mobilization work. Owner's acceptance of the plan will be conditional and predicated on continuing satisfactory adherence to the plan. Owner reserves the right to require Contractor to make changes to the plan and operations, including removal of personnel, as necessary, to obtain specified quality of work results.

D. Quality-Control Personnel Qualifications. Engage a person with requisite training and experience to implement and manage quality assurance (QA) and quality control (QC) for the project.

1.09 REFERENCES AND STANDARDS

1.10 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Owner will employ services of an independent testing agency to perform certain specified testing; payment for cost of services will be derived from allowance specified in Section 01 2100; see Section 01 2100 and applicable sections for description of services included in allowance.

B. Owner will employ and pay for services of an independent testing agency to perform other specified testing.

C. Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.

D. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

E. Contractor Employed Agency:

1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, ASTM E699, ASTM C1021, ASTM C1077, ASTM C1093, ASTM D3740 and [_____].

2. Laboratory: Authorized to operate in Maryland.

3. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
4. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.

B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.

C. Integrated Exterior Mock-ups: Construct integrated exterior mock-up as indicated on drawings. Coordinate installation of exterior envelope materials and products as required in individual Specification Sections. Provide adequate supporting structure for mock-up materials as necessary.

D. Room Mock-ups: Construct room mock-ups as indicated on drawings. Coordinate installation of materials, products, and assemblies as required in specification sections; finish according to requirements. Provide required lighting and any supplemental lighting where required to enable Architect to evaluate quality of the mock-up.

E. Notify Architect fifteen (15) working days in advance of dates and times when mock-ups will be constructed.

F. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.

G. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.

H. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

I. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.

1. Architect will issue written comments within seven (7) working days of initial review and each subsequent follow up review of each mock-up.

2. Make corrections as necessary until Architect's approval is issued.

J. Accepted mock-ups shall be a comparison standard for the remaining Work.

K. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

3.03 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

A. See individual specification sections for testing and inspection required.

B. Testing Agency Duties:

1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.

2. Perform specified sampling and testing of products in accordance with specified standards.

3. Ascertain compliance of materials and mixes with requirements of Contract Documents.

4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.

5. Perform additional tests and inspections required by Architect .

6. Attend preconstruction meetings and progress meetings.

7. Submit reports of all tests/inspections specified.

C. Limits on Testing/Inspection Agency Authority:

1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.

2. Agency may not approve or accept any portion of the Work.

3. Agency may not assume any duties of Contractor .

4. Agency has no authority to stop the Work.

D. Contractor Responsibilities:

1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.

2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.

3. Provide incidental labor and facilities:

a. To provide access to Work to be tested/inspected.

b. To obtain and handle samples at the site or at source of Products to be tested/inspected.

c. To facilitate tests/inspections.

d. To provide storage and curing of test samples.

4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
6. Arrange with Owner 's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.05 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.06 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

B. If, in the opinion of Owner, it is not practical to remove and replace the work, Owner will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 01 4100
REGULATORY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY OF REFERENCE STANDARDS

A. Regulatory requirements applicable to this project are the following:

B. 28 CFR 35 - Nondiscrimination on the Basis of Disability in State and Local Government Services; Final Rule; Department of Justice current edition.

C. 28 CFR 36 - Nondiscrimination by Public Accommodations and in Commercial Facilities; Final Rule; Department of Justice current edition.

D. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines current edition.

E. 49 CFR 27, 37, and 38 - Transportation for Individuals with Disabilities; Final Rule; Department of Transportation current edition.

F. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

G. FED-STD-795 - Uniform Federal Accessibility Standards (UFAS) 1988.

H. 29 CFR 1910 - Occupational Safety and Health Standards current edition.

I. State of Maryland amendments to some or all of the following.

J. City of Upper Marlboro amendments to some or all of the following.

K. Zoning Code: 20772.

L. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

M. ICC (IFC) - International Fire Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

N. NFPA 1 - Fire Code 2018.

O. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

P. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

Q. ICC (IPC) - International Plumbing Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

R. IAPMO (UPC) - Uniform Plumbing Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

S. ICC (IMC) - International Mechanical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

T. IAPMO (UPC) - Uniform Plumbing Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

U. ICC (IFGC) - International Fuel Gas Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

V. ICC (IPSDC) - International Private Sewage Disposal Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

W. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

X. ICC (IECC) - International Energy Conservation Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

Y. ICC (IPMC) - International Property Maintenance Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

Z. Erosion and Sedimentation Control Regulations: [_____].

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements.

B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.

1.03 SECTION INCLUDES

A. General: Comply with the applicable Articles and Sections of the Annotated Code of Maryland.

1.04 QUALITY ASSURANCE

A. General Safety and Health Regulations.

B. Discrimination

C. Environmental Statutes and Regulations

D. Miscellaneous Regulations.

1. 1. Buy American Steel Act
2. 2. Financial Disclosure
3. 3. Political Contribution Disclosure
4. 4. Retention of Records

1.05 GENERAL SAFETY AND HEALTH REGULATIONS.

A. The use of products containing asbestos will not be permitted.

B. Nothing contained in the Contract shall be construed as relieving Contractor in any way of Contractor's responsibility for strict compliance with all governmentalrequirements, pertaining to health and safety.

C. The Contract is to be governed at all times by applicable provisions of federal law, including but not limited to the following:

1. Williams-Steiger Occupational Safety and Health Act of 1970, Public Law 91-596.
2. 2. Part 1910 - Occupational Safety and Health Standards, Chapter XIII of Title 29, Code of Federal Regulations
3. Maryland State Safety Health Act (MOSHA)

D. MARYLAND BUY AMERICAN STEEL ACT: The Contractor shall comply with Section 17-301 through Section 17-306 of Annotated Code of Maryland, State Finance and Procurement Article. The "Buy American Steel" Act of Maryland defines "steel products" as any product: "rolled, formed, shaped, drawn, extruded, forged, cast, fabricated, or otherwise similarly processed, or processed by a combination of two or more of such operations, from steel made in the United States by the open hearth, basic oxygen, electric furnace, bessemer, or other steel making process."

E. Project safety procedures/policies for construction activities shall be adhered to at all times. Refer to PART 3 - EXECUTION for further safety information and requirements.

1.06 DISCRIMINATION

A. FINANCIAL DISCLOSURE: The Contractor shall comply with the provisions of Section 13-221 of the State Finance and Procurement Article, Annotated Code of Maryland. Every business that enters into contracts, leases, or other agreements, with that State of Maryland or its agencies, during a calendar year under which the business is to receive in the aggregate $100,000 or more, shall within 30 days of the time when aggregate value of these contracts, leases to other agreements reached $100,000, file with the Secretary of State of Maryland certain specified information to include disclosure of beneficial ownership of the business.

B. POLITICAL CONTRIBUTION DISCLOSURE: The Contractor shall comply with the provisions of Article 33, Section 30-1 through 30-4 the Annotated Code of Maryland, which requires that every person that enters into contracts , leases, or other agreements with the State of Maryland during a calendar year under which the business is to receive in the aggregate $10,000 or more, shall on or before February 1, of the following year file with the Secretary of State of Maryland certain specified information to include disclosure of political contributions in excess of $100 to a candidate for elective office in any primary or general election.

C. RETENTION OF RECORDS: The Contractor shall retain and maintain all records and documents relating to this contract for three years after final payment by the Owner or any applicable statute of limitations, whichever is longer, and shall make them available for inspection and audit by the Owners authorized representatives at all times.

D. DRUGS, TOBACCO AND ALCOHOL: All of the School properties are "drug, tobacco, and alcohol free zones" as designated by state and local laws. Neither the Contractor nor any of his employees or subcontractors are permitted to have any drugs, tobacco, or alcohol products on school property. Use or possession of such items on school properties will result in immediate termination of the Contract. Upon termination of the contract, the contractor will be paid for all services performed to date but will not be paid for any lost or anticipated profits due to termination of the Contract. The Contractor will be removed from all bids with the Prince George's County Public Schools for a period not to exceed two years. Prince George's County Public Schools will provide an unsatisfactory reference when inquiries are made.

E. The Contractor shall not discriminate against any employee or applicant because of race, creed, color or national origin. The Contractor shall take affirmative action to ensure that applicants are employed and that employees are treated during employment without regard to their race, creed, color or national origin. Such action shall include but not be limited to the following: employment, upgrading, demotion, or transfer; rates of pay or other forms of compensation; and selection for training including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment notices to be provide by the Owner concerning discrimination.

F. The Contractor shall send to each labor union or representative of workers with which he has collective bargaining agreements or contract or understanding a notice to be provided by the Owner advising the said union or worker's representative of the Contractor's commitments under this section, and the Contractor shall post copies of the notice in conspicuous places available to employees and applicants for employment.

G. The Contractor shall furnish, if requested by the Owner a compliance report concerning their employment practices and policies in order for the Owner to ascertain compliance with the special provisions of this contract concerning discrimination in employment.

H. In the event of the Contractor's noncompliance with the nondiscrimination clause of this contract, this contract maybe canceled, terminated or suspended in whole or in part and the Contractor may be declared in eligible for further Prince George's County Public School work.

I. The Contractor shall include the special provisions outlined herein, pertaining to nondiscrimination in employment in every subcontract or purchase order utilized by him in order to carry out the terms and conditions of this contract. So that such nondiscrimination in employment provisions shall be binding on each subcontract.

1.07 ENVIRONMENTAL PROTECTION

A. A. Contractor shall comply with all applicable provisions of federal and state laws dealing with the prevention of environmental pollution and the preservation of natural resources, including but not limited to the Federal Air Quality Act of 1967; the Clean Air Act; the Clean Water Restoration act; the Water Pollution Control Act Amendments of 1956; the Water Quality Act of 1965; the Water Quality Improvement Act of 1970; the Water Pollution Control Act Amendments of 1972; the Water Facilities Act (see Consolidated Farmer's Home Administration Act of 1961); the Watershed Protection and Flood Prevention Act; the Clean Streams Law; the Solid Waste Management Act; the Municipal Waste Planning, Recycling and Waste Reduction Act; A.H.E.R.A; and all rules and regulations thereunder, including but not limited to, those formulated by the United States Environmental Protection Agency, the Maryland Department of the Environment. Nothing contained in the Contract shall be construed as relieving Contractor in any way of Contractor's responsibility for strict compliance with all governmental requirements pertaining to environmental protection.

B. Nothing contained in the Contract Documents for construction shall be construed by the Contractor as relieving him in any way of his responsibility for strict compliance with the statues, rules and regulations contained in the above mentioned Environmental Protection Act.

1.08 MISCELLANEOUS REGULATIONS

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SAFETY REQUIREMENTS

A. All work shall be performed in accordance with rules, regulations, procedures and safe practices and/or OSHA and all other Government agencies having jurisdiction over the project.

B. MARYLAND OCCUPATIONAL SAFETY & HEALTH (MOSH) REQUIREMENTS All contracts with the BOARD OF EDUCATION OF PRINCE GEORGE’S COUNTY shall be governed by the STATE OF MARYLAND OCCUPATIONAL SAFETY AND HEALTH (MOSH) LAWS. Where any difference(s) may exist between any particular MOSH standard(s) and the corresponding, related United States Occupational Safety and Health Administration (OSHA) standard(s), MOSH LAW SHALL TAKE PRECEDENCE.

1. Information pertaining to any particular MOSH Law(s) may be obtained from: STATE OF MARYLAND DEPARTMENT OF LICENSING AND REGULATION Division of Labor and Industry/Maryland Occupational Safety and Health 1100 North Eutaw Street Baltimore, Maryland 21202 Telephone No.: 410-767-2215

3.02 SAFETY PRECAUTIONS AND PROGRAMS:

A. Each Contractor shall be responsible for initiating, maintaining and supervising safety precautions and programs in connection with the work.

B. All Contractors shall comply with the provisions of the "Occupational Safety and Health Act" and Federal, State and local requirements.

C. If a Contractor fails to maintain the safety precautions required by law or directed by authorities having jurisdiction, the Owner may take such action as necessary and charge the Contractor therefore. The failure of the Owner to take any such action shall not relieve the Contractor of his obligations.

D. The Contractor individually shall be responsible for the safety, efficiency, and adequacy of his plant, appliances, and methods and for any damage which may result from their failure or their improper construction, maintenance or operation.

E. Prior to mobilizing to the job, the Contractor shall submit, in writing, a description of his safety program. During the conduct of the work, the Contractor shall immediately notify the Owner and Architect in writing of all accidents and shall submit a written report describing in detail the circumstances of each accident within 24'hours of its occurrence. All Contractors shall notify the Architect of any flammable, combustible and/or toxic materials intended for use on the project and shall furnish literature pertinent to the use and control of all materials, including, but not limited to M.S.D.S. sheets.

F. Each Contractor shall delegate one representative who shall be responsible to maintain all safety requirements of the Contractor.

3.03 SAFETY OF PERSONS AND PROPERTY:

A. The Contractor shall take all reasonable precautions for the safety of, and shall provide all reasonable protection to prevent damage or loss to:

1. All school personnel, employees on the work site and all other persons who may be affected thereby.

2. All the work and all materials and equipment to be incorporated therein, whether in storage on or off the site, under the care, custody or control of the Contractor or any of his Subcontractors or Sub-Subcontractors.

3. Other property at the site or adjacent thereto, including but not limited to trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction and underground property.

B. The Contractor shall give all notices and 'comply with all applicable laws, ordinances, rules, regulations and lawful orders of any public authority, including the Owner's requirements bearing on the Safety of persons or property or their protection from damage, injury or loss.

C. The Contractor shall erect and maintain, as required by existing conditions and progress of the work, all reasonable safeguards for safety and protection, including danger signs and other warnings against hazards.

D. The Contractor shall promptly remedy all damage or loss to any property caused in whole or in part by the Contractor, his Subcontractors, his Sub-Subcontractors, or anyone directly employed by any of them, or by anyone for whose acts any of them be liable.

E. The Contractor shall not load or permit any part of the work to be loaded so as to endanger its integrity and safety.

END OF SECTION

A. Contractors using a method of blasting to perform work on the project shall use all proper methods, including adequate safety matting and/or overburden, progressive time sequences and scaled distances, in accordance with all governmental regulations.

B. The use of audio equipment and headsets will not be permitted on the construction site.

4.02 PERSONAL PROTECTION REQUIREMENTS

A. All persons entering the project shall wear hard hats in good condition and meet ANSI 289.11997. Hard hats shall be worn in the proper manner.

B. All persons entering the project 'shall wear proper work boots, clothing and attire including long trousers and shirts. No obscene or inappropriate messages may be displayed on clothing. What constitutes

obscene or inappropriate will be at the sole discretion of the Owner.

C. All job site personnel are expected to strictly adhere to the following rules and regulations:

1. Use of approved eye protection by all Contractor personnel shall be required during all types of percussion and reciprocating work or when other requirements govern.
2. Approved respiratory equipment shall be worn by all personnel exposed to hazardous volumes of toxic or noxious dusts, fumes, mists, or gases
3. Personal protective equipment is to be used under unusual conditions, such as high temperature work, handling caustic or corrosive liquids, or molten metals.
4. The Contractor is responsible for providing safety training to all of his employees.
5. All shipments to the site shall have the required documentation and labels attached and the documentation and labels shall be maintained while the material is on site.
6. As defined in the occupational Safety & Health Act, safety belts, complete with lanyards, or parachute-style harness, complete with lanyard, are to be used where there is a danger of falling.

4.03 HOUSEKEEPING

A. Materials and equipment must be piled up or stored in a safe manner. Aisles must be kept clear

B. All drop cables/extension cords shall be elevated above the ground or protected in such a way to allow traffic to pass.

C. Consumption of food and beverages shall be in designated areas and at specified times.

D. Glass-bottled refreshments will not be allowed in the workplace.

E. Welding stubs and shells from explosive activated tools shall be collected and properly disposed of by Contractor.

F. The cords and connections at temporary panels must be maintained in an orderly fashion at all times to prevent tripping.

G. Nails are to be bent over and/or removed from wood.

H. Aisles, stairwells and base areas of ladders are to be kept clear at all times.

4.04 M.S.D.S.-CONTROLLED PRODUCTS

A. The Contractor is responsible for notifying the Owner, of any controlled products that they bring or cause to have brought onto the site. The Contractor shall submit copies of the Material Safety Data Sheet (M.S.D.S.) for the controlled product, and the Contractor shall retain a copy of the M.S.D.S. on site for their own reference. The legal storage, use, and disposal of any controlled product is the responsibility of the Contractor.

B. The Contractor shall comply with OSHA Communications' Standards 29 CFR 1910-1200 for hazardous materials. The Contractor shall maintain a Material Safety Data Sheet on file at the jobsite for each chemical brought to the site.

C. In any emergency affecting the safety or persons or property, the Contractor shall act, at his discretion, to prevent threatened damage, injury or loss and shall immediately notify the Owner and Architect of such emergency conditions. Any claims made by the Contractor for additional compensation or extension of time on account of emergency work shall be processed in accordance with the Conditions of the Contract.

D. Temporary storage of hazardous materials shall be the responsibility of the Contractor. Final cleanup and removal shall be by the Contractor.

4.05 EMERGENCIES

SECTION 01410 REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. General: Comply with the applicable Articles and Sections of the Annotated Code of Maryland.

B. General Safety and Health Regulations.

C. Discrimination

D. Environmental Statutes and Regulations

E. Miscellaneous Regulations.

1. Buy American Steel Act
2. Financial Disclosure
3. Political Contribution Disclosure
4. Retention of Records

1.3 GENERAL SAFETY AND HEALTH REGULATIONS.

A. The use of products containing asbestos will not be permitted.

B. Nothing contained in the Contract shall be construed as relieving Contractor in any way of Contractor's responsibility for strict compliance with all governmental requirements, pertaining to health and safety.

C. The Contract is to be governed at all times by applicable provisions of federal law, including but not limited to the following:

1. Williams-Steiger Occupational Safety and Health Act of 1970, Public Law 91-596.
2. Part 1910 - Occupational Safety and Health Standards, Chapter XIII of Title 29, Code of Federal Regulations
3. Maryland State Safety Health Act (MOSHA)

D. Project safety procedures/policies for construction activities shall be adhered to at all times. Refer to PART 3 - EXECUTION for further safety information and requirements.

1.4 DISCRIMINATION

A. The Contractor shall not discriminate against any employee or applicant because of race, creed, color or national origin. The Contractor shall take affirmative action to ensure that applicants are employed and that employees are treated during employment without regard to their race, creed, color or national origin. Such action shall include but not be limited to the following: employment, upgrading, demotion, or transfer; rates of pay or other forms of compensation; and selection for training including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment notices to be provide by the Owner concerning discrimination.

B. The Contractor shall send to each labor union or representative of workers with which he has collective bargaining agreements or contract or understanding a notice to be provided by the Owner advising the said union or worker's representative of the Contractor's commitments under this section, and the Contractor shall post copies of the notice in conspicuous places available to employees and applicants for employment.

C. The Contractor shall furnish, if requested by the Owner a compliance report concerning their employment practices and policies in order for the Owner to ascertain compliance with the special provisions of this contract concerning discrimination in employment.

D. In the event of the Contractor's noncompliance with the nondiscrimination clause of this contract, this contract maybe canceled, terminated or suspended in whole or in part and the Contractor may be declared in eligible for further Prince George's County Public School work.

E. The Contractor shall include the special provisions outlined herein, pertaining to nondiscrimination in employment in every subcontract or purchase order utilized by him in order to carry out the terms and conditions of this contract. So that such nondiscrimination in employment provisions shall be binding on each subcontract.

1.5 ENVIRONMENTAL PROTECTION

A. Contractor shall comply with all applicable provisions of federal and state laws dealing with the prevention of environmental pollution and the preservation of natural resources, including but not limited to the Federal Air Quality Act of 1967; the Clean Air Act; the Clean Water Restoration act; the Water Pollution Control Act Amendments of 1956; the Water Quality Act of 1965; the Water Quality Improvement Act of 1970; the Water Pollution Control Act Amendments of 1972; the Water Facilities Act (see Consolidated Farmer's Home Administration Act of 1961); the Watershed Protection and Flood Prevention Act; the Clean Streams Law; the Solid Waste Management Act; the Municipal Waste Planning, Recycling and Waste Reduction Act; A.H.E.R.A; and all rules and regulations thereunder, including but not limited to, those formulated by the United States Environmental Protection Agency, the Maryland Department of the Environment. Nothing contained in the Contract shall be construed as relieving Contractor in any way of Contractor's responsibility for strict compliance with all governmental requirements pertaining to environmental protection.

B. Nothing contained in the Contract Documents for construction shall be construed by the Contractor as relieving him in any way of his responsibility for strict compliance with the

statues, rules and regulations contained in the above mentioned Environmental Protection Act.

1.6 MISCELLANEOUS REGULATIONS

A. MARYLAND BUY AMERICAN STEEL ACT: The Contractor shall comply with Section 17-301 through Section 17-306 of Annotated Code of Maryland, State Finance and Procurement Article. The "Buy American Steel" Act of Maryland defines "steel products" as any product: "rolled, formed, shaped, drawn, extruded, forged, cast, fabricated, or otherwise similarly processed, or processed by a combination of two or more of such operations, from steel made in the United States by the open hearth, basic oxygen, electric furnace, bessemer, or other steel making process**."**

B. FINANCIAL DISCLOSURE: The Contractor shall comply with the provisions of Section 13-221 of the State Finance and Procurement Article, Annotated Code of Maryland. Every business that enters into contracts, leases, or other agreements, with that State of Maryland or its agencies, during a calendar year under which the business is to receive in the aggregate $100,000 or more, shall within 30 days of the time when aggregate value of these contracts, leases to other agreements reached $100,000, file with the Secretary of State of Maryland certain specified information to include disclosure of beneficial ownership of the business.

C. POLITICAL CONTRIBUTION DISCLOSURE: The Contractor shall comply with the provisions of Article 33, Section 30-1 through 30-4 the Annotated Code of Maryland, which requires that every person that enters into contracts , leases, or other agreements with the State of Maryland during a calendar year under which the business is to receive in the aggregate $10,000 or more, shall on or before February 1, of the following year file with the Secretary of State of Maryland certain specified information to include disclosure of political contributions in excess of $100 to a candidate for elective office in any primary or general election.

D. RETENTION OF RECORDS: The Contractor shall retain and maintain all records and documents relating to this contract for three years after final payment by the Owner or any applicable statute of limitations, whichever is longer, and shall make them available for inspection and audit by the Owners authorized representatives at all times.

E. DRUGS, TOBACCO AND ALCOHOL: All of the School properties are "drug, tobacco, and alcohol free zones" as designated by state and local laws. Neither the Contractor nor any of his employees or subcontractors are permitted to have any drugs, tobacco, or alcohol products on school property. Use or possession of such items on school properties will result in immediate termination of the Contract.

Upon termination of the contract, the contractor will be paid for all services performed to date but will not be paid for any lost or anticipated profits due to termination of the Contract. The Contractor will be removed from all bids with the Prince George's County Public Schools for a period not to exceed two years. Prince George's County Public Schools will provide an unsatisfactory reference when inquiries are made.

PART 2 - PRODUCTS Not Used.

PART 3 - EXECUTION

3.1 SAFETY REQUIREMENTS

A. All work shall be performed in accordance with rules, regulations, procedures and safe practices and/or OSHA and all other Government agencies having jurisdiction over the project.

B. MARYLAND OCCUPATIONAL SAFETY & HEALTH (MOSH) REQUIREMENTS

All contracts with the BOARD OF EDUCATION OF PRINCE GEORGE'S COUNTY shall be governed by the STATE OF MARYLAND OCCUPATIONAL SAFETY AND HEALTH (MOSH) LAWS. Where any difference(s) may exist between any particular MOSH standard(s) and the corresponding, related United States Occupational Safety and Health Administration (OSHA) standard(s), MOSH LAW SHALL TAKE PRECEDENCE.

1. Information pertaining to any particular MOSH Law(s) may be obtained from:

STATE OF MARYLAND DEPARTMENT OF LICENSING AND REGULATION
Division of Labor and Industry/Maryland Occupational Safety and Health
1100 North Eutaw Street
Baltimore, Maryland 21202
Telephone No.: 410-767-2215

3.2 SAFETY PRECAUTIONS AND PROGRAMS:

A. Each Contractor shall be responsible for initiating, maintaining and supervising safety precautions and programs in connection with the work.

B. All Contractors shall comply with the provisions of the "Occupational Safety and Health Act" and Federal, State and local requirements.

C. If a Contractor fails to maintain the safety precautions required by law or directed by authorities having jurisdiction, the Owner may take such action as necessary and charge the Contractor therefore. The failure of the Owner to take any such action shall not relieve the Contractor of his obligations.

D. The Contractor individually shall be responsible for the safety, efficiency, and adequacy of his plant, appliances, and methods and for any damage which may result from their failure or their improper construction, maintenance or operation.

E. Prior to mobilizing to the job, the Contractor shall submit, in writing, a description of his safety program. During the conduct of the work, the Contractor shall immediately notify the Owner and Architect in writing of all accidents and shall submit a written report describing in detail the circumstances of each accident within 24'hours of its occurrence. All Contractors shall notify the Architect of any flammable, combustible and/or toxic

materials intended for use on the project and shall furnish literature pertinent to the use and control of all materials, including, but not limited to M.S.D.S. sheets.

F. Each Contractor shall delegate one representative who shall be responsible to maintain all safety requirements of the Contractor.

3.3 SAFETY OF PERSONS AND PROPERTY:

A. The Contractor shall take all reasonable precautions for the safety of, and shall provide all reasonable protection to prevent damage or loss to:

1. All school personnel, employees on the work site and all other persons who may be affected thereby.

2. All the work and all materials and equipment to be incorporated therein, whether in storage on or off the site, under the care, custody or control of the Contractor or any of his Subcontractors or Sub-Subcontractors.

3. Other property at the site or adjacent thereto, including but not limited to trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction and underground property.

B. The Contractor shall give all notices and 'comply with all applicable laws, ordinances, rules, regulations and lawful orders of any public authority, including the Owner's requirements bearing on the Safety of persons or property or their protection from damage, injury or loss.

C. The Contractor shall erect and maintain, as required by existing conditions and progress of the work, all reasonable safeguards for safety and protection, including danger signs and other warnings against hazards.

D. The Contractor shall promptly remedy all damage or loss to any property caused in whole or in part by the Contractor, his Subcontractors, his Sub-Subcontractors, or anyone directly employed by any of them, or by anyone for whose acts any of them be liable.

E. The Contractor shall not load or permit any part of the work to be loaded so as to endanger its integrity and safety.

F. Contractors using a method of blasting to perform work on the project shall use all proper methods, including adequate safety matting and/or overburden, progressive time sequences and scaled distances, in accordance with all governmental regulations.

G. The use of audio equipment and headsets will not be permitted on the construction site.

3.4 PERSONAL PROTECTION REQUIREMENTS

A. All persons entering the project shall wear hard hats in good condition and meet ANSI 289.11997. Hard hats shall be worn in the proper manner.

B. All persons entering the project 'shall wear proper work boots, clothing and attire including long trousers and shirts. No obscene or inappropriate messages may be displayed on clothing. What constitutes obscene or inappropriate will be at the sole discretion of the Owner.

C. All job site personnel are expected to strictly adhere to the following rules and regulations:

1. Use of approved eye protection by all Contractor personnel shall be required during all types of percussion and reciprocating work or when other requirements govern.

2. Approved respiratory equipment shall be worn by all personnel exposed to hazardous volumes of toxic or noxious dusts, fumes, mists, or gases.

3. Personal protective equipment is to be used under unusual conditions, such as high temperature work, handling caustic or corrosive liquids, or molten metals.

4. The Contractor is responsible for providing safety training to all of his employees.
5. All shipments to the site shall have the required documentation and labels attached and the documentation and labels shall be maintained while the material is on site.

6. As defined in the occupational Safety & Health Act, safety belts, complete with lanyards, or parachute-style harness, complete with lanyard, are to be used where there is a danger of falling.

3.5 HOUSEKEEPING

A. Materials and equipment must be piled up or stored in a safe manner. Aisles must be kept clear.

B. All drop cables/extension cords shall be elevated above the ground or protected in such a way to allow traffic to pass.

C. Consumption of food and beverages shall be in designated areas and at specified times.

D. Glass-bottled refreshments will not be allowed in the workplace.

E. Welding stubs and shells from explosive activated tools shall be collected and properly disposed of by Contractor.

F. The cords and connections at temporary panels must be maintained in an orderly fashion at all times to prevent tripping.

G. Nails are to be bent over and/or removed from wood.

H. Aisles, stairwells and base areas of ladders are to be kept clear at all times.

3.6 M.S.D.S.-CONTROLLED PRODUCTS

A. The Contractor is responsible for notifying the Owner, of any controlled products that they bring or cause to have brought onto the site. The Contractor shall submit copies of the Material Safety Data Sheet (M.S.D.S.) for the controlled product, and the Contractor shall retain a copy of the M.S.D.S. on site for their own reference. The legal storage, use, and disposal of any controlled product is the responsibility of the Contractor.

B. The Contractor shall comply with OSHA Communications' Standards 29 CFR 1910-1200 for hazardous materials. The Contractor shall maintain a Material Safety Data Sheet on file at the jobsite for each chemical brought to the site.

C. Temporary storage of hazardous materials shall be the responsibility of the Contractor. Final cleanup and removal shall be by the Contractor.

3.7 EMERGENCIES

A. In any emergency affecting the safety or persons or property, the Contractor shall act, at his discretion, to prevent threatened damage, injury or loss and shall immediately notify the Owner and Architect of such emergency conditions. Any claims made by the Contractor for additional compensation or extension of time on account of emergency work shall be processed in accordance with the Conditions of the Contract.

END OF SECTION

SECTION 01 5000
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Dewatering

B. Temporary utilities.

C. Temporary telecommunications services.

D. Temporary sanitary facilities.

E. Temporary Controls: Barriers, enclosures and fencing.

F. Security requirements.

G. Vehicular access and parking.

H. Waste removal facilities and services.

I. Project identification sign.

J. Field offices.

1.02 RELATED REQUIREMENTS

A. Section 01 3553 - Security Procedures

B. Section 01 5100 - Temporary Utilities.

C. Section 01 5213 - Field Offices and Sheds.

D. Section 01 5500 - Vehicular Access and Parking.

E. Section 01 5813 - Temporary Project Signage.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2018b.

B. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).

1.04 DEWATERING

A. Provide temporary means and methods for dewatering all temporary facilities and controls.

B. Maintain temporary facilities in operable condition.

1.05 TEMPORARY UTILITIES - SEE SECTION 01 5100

A. Provide and pay for all electrical power, lighting, water, heating and cooling and ventilation required for construction purposes.

1.06 TELECOMMUNICATIONS SERVICES

A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.

B. Telecommunications services shall include:

1. Windows-based personal computer dedicated to project telecommunications, with necessary software and laser printer.

2. Telephone Land Lines: One line, minimum; one handset per line.

3. Internet Connections: Minimum of one; DSL modem or faster.

4. Email: Account/address reserved for project use.

1.07 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Maintain daily in clean and sanitary condition.

C. At end of construction, return facilities to same or better condition as originally found.

1.08 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

C. Provide protection for plants designated to remain. Replace damaged plants.

D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.09 FENCING

A. Construction: Commercial grade chain link fence.

B. Provide 6 foot (1.8 m) high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.10 EXTERIOR ENCLOSURES

A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.11 INTERIOR ENCLOSURES

A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.

B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:

1. STC rating of 35 in accordance with ASTM E90.

2. Maximum flame spread rating of 75 in accordance with ASTM E84.

1.12 SECURITY - SEE SECTION 01 3553

A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

B. Coordinate with Owner 's security program.

1.13 VEHICULAR ACCESS AND PARKING - SEE SECTION 01 5500

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.

B. Coordinate access and haul routes with governing authorities and Owner .

C. Provide and maintain access to fire hydrants, free of obstructions.

D. Provide means of removing mud from vehicle wheels before entering streets.

E. Designated existing on-site roads may be used for construction traffic.

F. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

G. Provide one parking space for Owner use.

H. Provide one parking space for Architect use.

1.14 WASTE REMOVAL

A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

B. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

C. Provide containers with lids. Remove trash from site periodically.

D. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.15 PROJECT IDENTIFICATION

A. Provide project identification sign of design, construction, and location approved by Owner .

B. No other signs are allowed without Owner permission except those required by law.

1.16 FIELD OFFICES - SEE SECTION 01 5213

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack and drawing display table.

B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.

C. Locate offices a minimum distance of 30 feet (10 m) from existing and new structures.

1.17 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.

B. Remove underground installations to a minimum depth of 2 feet (600 mm). Grade site as indicated.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore existing facilities used during construction to original condition.

E. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01510 - TEMPORARY UTILITIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Temporary Utilities: Electricity, lighting, heat, ventilation, and water.

1.2 TEMPORARY ELECTRICITY

A. Cost: By Contractor.

B. Provide power service required from utility source.

C. Complement existing power service capacity and characteristics as required.

D. Provide power outlets for construction operations, with branch wiring and distribution boxes located at each floor. Provide flexible power cords as required.

E. Provide main service disconnect and over-current protection at convenient location and meter.

F. Permanent convenience receptacles may be utilized during construction.

G. Provide adequate distribution equipment, wiring, and outlets to provide single phase branch circuits for power and lighting.

1.3 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. Provide and maintain incandescent lighting for construction operations to achieve a minimum lighting level of 2 watt/sq ft.

B. Provide and maintain 1 watt/sq ft lighting to exterior staging and storage areas after dark for security purposes.

C. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.

D. Maintain lighting and provide routine repairs.

E. Permanent building lighting may be utilized during construction.

1.4 TEMPORARY HEATING

A. Cost of Energy: By Contractor.

B. Provide heating devices and heat as needed to maintain specified conditions for construction operations.

C. Maintain minimum ambient temperature of 50 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.

D. Prior to operation of permanent equipment for temporary heating purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

1.5 TEMPORARY COOLING

A. Cost of Energy: By Contractor.

B. Provide cooling devices and cooling as needed to maintain specified conditions for construction operations.

C. Maintain maximum ambient temperature of 80 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.

D. Prior to operation of permanent equipment for temporary cooling purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

1.6 TEMPORARY VENTILATION

A. Utilize existing ventilation equipment. Extend and supplement equipment with temporary fan units as required to maintain clean air for construction operations.

1.7 TEMPORARY WATER SERVICE

A. Cost of Water Used: By Owner/Contractor.

B. Provide and maintain suitable quality water service for construction operations at time of project mobilization.

C. Connect to existing water source.
   1. Exercise measures to conserve water.

D. Extend branch piping with outlets located so water is available by hoses with threaded connections. Provide temporary pipe insulation to prevent freezing.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 5500
VEHICULAR ACCESS AND PARKING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Access roads.

B. Parking.

C. Existing pavements and parking areas.

D. Permanent pavements and parking facilities.

E. Construction parking controls.

F. Flag persons.

G. Flares and lights.

H. Haul routes.

I. Traffic signs and signals.

J. Maintenance.

K. Removal, repair.

L. Mud from site vehicles.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: For access to site, work sequence and occupancy.

B. Section 01 5813 - Temporary Project Signage: Post Mounted and Wall Mounted Traffic Control and Informational Signs.

C. Section 31 2200 - Grading: Specifications for earthwork and paving bases.

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials for Permanent Construction: As specified in product specification sections, including earthwork, paving base and topping.

2.02 SIGNS, SIGNALS, AND DEVICES

A. Post Mounted and Wall Mounted Traffic Control and Informational Signs: Specified in Section 01 5813 - Temporary Project Signage.

B. Automatic Traffic Control Signals: As approved by local jurisdictions.

C. Traffic Cones and Drums, Flares and Lights: As approved by local jurisdictions.

D. Flag Person Equipment: As required by local jurisdictions.

PART 3 EXECUTION

3.01 PREPARATION

A. Clear areas, provide surface and storm drainage of road, parking, area premises, and adjacent areas.

3.02 ACCESS ROADS

A. Use of existing on-site streets and driveways for construction traffic is permitted.

B. Construct new temporary all-weather access roads from public thoroughfares to serve construction area, of a width and load bearing capacity to provide unimpeded traffic for construction purposes.

C. Construct temporary bridges and culverts to span low areas and allow unimpeded drainage.

D. Extend and relocate as work progress requires, provide detours as necessary for unimpeded traffic flow.

E. Location as approved by Architect .

F. Provide unimpeded access for emergency vehicles. Maintain 20 foot (6 m) width driveways with turning space between and around combustible materials.

G. Provide and maintain access to fire hydrants free of obstructions.

3.03 PARKING

A. Use of designated areas of existing parking facilities by construction personnel is permitted.

B. Use of designated areas of new parking facilities by construction personnel is permitted.

C. When site space is not adequate, provide additional off-site parking.

D. Locate as approved by Architect .

3.04 PERMANENT PAVEMENTS AND PARKING FACILITIES

A. Prior to Substantial Completion the base for permanent roads and parking areas may be used for construction traffic.

3.05 CONSTRUCTION PARKING CONTROL

A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and Owner's operations.

B. Monitor parking of construction personnel's vehicles in existing facilities. Maintain vehicular access to and through parking areas.

C. Prevent parking on or adjacent to access roads or in non-designated areas.

3.06 FLAG PERSONS

A. Provide trained and equipped flag persons to regulate traffic when construction operations or traffic encroach on public traffic lanes.

3.07 HAUL ROUTES

A. Drawings indicate haul routes designated by authorities for use of construction traffic.

B. Confine construction traffic to designated haul routes.

C. Provide traffic control at critical areas of haul routes to regulate traffic, to minimize interference with public traffic.

3.08 TRAFFIC SIGNS AND SIGNALS

A. At approaches to site and on site, install at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.

B. Relocate as work progresses, to maintain effective traffic control.

3.09 MAINTENANCE

A. Maintain traffic and parking areas in a sound condition free of excavated material, construction equipment, products, mud, snow, and ice.

B. Maintain existing paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original, or specified,

condition.

3.10 REMOVAL, REPAIR

A. Remove temporary roads when permanent paving is usable.

B. Remove underground work and compacted materials to a depth of 2 feet (600 mm); fill and grade site as specified.

C. Repair existing facilities damaged by use, to original condition.

D. Remove equipment and devices when no longer required.

E. Repair damage caused by installation.

F. Remove post settings to a depth of 2 feet (600 mm).

3.11 MUD FROM SITE VEHICLES

A. Provide means of removing mud from vehicle wheels before entering streets.

END OF SECTION

SECTION 01 5713
TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Prevention of erosion due to construction activities.

B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.

C. Restoration of areas eroded due to insufficient preventive measures.

D. Performance bond.

E. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor .

1.02 RELATED REQUIREMENTS

A. Section 01 3329 - Sustainable Design Reporting: Submittal procedures for sustainable design documentation.

B. Section 03 3000 - Cast-in-Place Concrete: Concrete for temporary and permanent erosion control structures indicated on drawings.

C. Section 31 1000 - Site Clearing: Limits on clearing; disposition of vegetative clearing debris.

D. Section 31 2200 - Grading: Temporary and permanent grade changes for erosion control.

E. Section 31 3700 - Riprap: Temporary and permanent stabilization using riprap.

F. Section 32 1123 - Aggregate Base Courses: Temporary and permanent roadways.

G. Section 32 9219 - Seeding: Permanent turf for erosion control.

H. Section 32 9223 - Sodding: Permanent turf for erosion control.

I. Section 32 9300 - Plants: Permanent plantings for erosion control.

1.03 REFERENCE STANDARDS

A. ASTM D4355/D4355M - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus 2014.

B. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity. 1999a (Reapproved 2014).

C. ASTM D4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles 2011.

D. ASTM D4632/D4632M - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles 2015a.

E. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile 2016.

F. ASTM D4873 - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples 2002 (Reapproved 2009).

G. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit Current Edition.

H. FHWA FLP-94-005 - Best Management Practices for Erosion and Sediment Control 1995.

I. USDA TR-55 - Urban Hydrology for Small Watersheds; USDA Natural Resources Conservation Service 2013.

1.04 PERFORMANCE REQUIREMENTS

A. Comply with requirements of EPA (NPDES) for erosion and sedimentation control, as specified by the NPDES, for Phases I and II, and in compliance with requirements of Construction General Permit (CGP), whether the project is required by law to comply or not.

B. Also comply with all more stringent requirements of State of Maryland Erosion and Sedimentation Control Manual.

C. Runoff Calculation Standard for Urban Areas: USDA TR-55.

D. Develop and follow an Erosion and Sedimentation Prevention Plan and submit periodic inspection reports.

E. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.

1. Obtain and pay for permits and provide security required by authority having jurisdiction.

F. Provide to Owner a Performance Bond covering erosion and sedimentation preventive measures only, in an amount equal to 100 percent of the cost of erosion and sedimentation control work.

G. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.

H. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.

1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.

2. Anticipate runoff volume due to the most extreme short term and 24-hour rainfall events that might occur in 25 years.

I. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.

1. Control movement of sediment and soil from temporary stockpiles of soil.

2. Prevent development of ruts due to equipment and vehicular traffic.

3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner .

J. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.

1. Prevent windblown soil from leaving the project site.

2. Prevent tracking of mud onto public roads outside site.

3. Prevent mud and sediment from flowing onto sidewalks and pavements.

4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner .

K. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.

1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner ; remove deposited sediments; comply with requirements of authorities having jurisdiction.

2. If sediment basins are used as temporary preventive measures, pump dry and remove deposited sediment after each storm.

L. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.

1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner ; remove deposited sediments; comply with requirements of authorities having jurisdiction.

M. Open Water: Prevent standing water that could become stagnant.

N. Maintenance: Maintain temporary preventive measures until permanent measures have been established.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Sustainable Design Documentation: Submit all submittals required in this section in accordance with procedures specified in Section 01 3329.

C. Erosion and Sedimentation Control Plan:

1. Submit within 2 weeks after Notice to Proceed.

2. Include:

a. Site plan identifying soils and vegetation, existing erosion problems, and areas vulnerable to erosion due to topography, soils, vegetation, or drainage.

b. Site plan showing grading; new improvements; temporary roads, traffic accesses, and other temporary construction; and proposed preventive measures.

c. Where extensive areas of soil will be disturbed, include storm water flow and volume calculations, soil loss predictions, and proposed preventive measures.

d. Schedule of temporary preventive measures, in relation to ground disturbing activities.

e. Other information required by law.

f. Format required by law is acceptable, provided any additional information specified is also included.

3. Obtain the approval of the Plan by authorities having jurisdiction.

4. Obtain the approval of the Plan by Owner .

D. Certificate: Mill certificate for silt fence fabric attesting that fabric and factory seams comply with specified requirements, signed by legally authorized official of manufacturer; indicate actual minimum average roll values; identify fabric by roll identification numbers.

E. Inspection Reports: Submit report of each inspection; identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.

F. Maintenance Instructions: Provide instructions covering inspection and maintenance for temporary measures that must remain after Substantial Completion.

PART 2 PRODUCTS

2.01 MATERIALS

A. Mulch: Use one of the following:

1. Straw or hay.

2. Wood waste, chips, or bark.

3. Erosion control matting or netting.

B. Grass Seed For Temporary Cover: Select a species appropriate to climate, planting season, and intended purpose. If same area will later be planted with permanent vegetation, do not use species known to be excessively competitive or prone to volunteer in subsequent seasons.

C. Bales: Air dry, rectangular straw bales.

1. Cross Section: 14 by 18 inches (350 by 450 mm), minimum.

2. Bindings: Wire or string, around long dimension.

D. Bale Stakes: One of the following, minimum 3 feet (1 m) long:

1. Steel U- or T-section, with minimum mass of 1.33 pound per linear foot (1.98 kg per linear m).

2. Wood, 2 by 2 inches (50 by 50 mm) in cross section.

E. Silt Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams with the following minimum average roll lengths:

1. Average Opening Size: 30 U.S. Std. Sieve (0.600 mm), maximum, when tested in accordance with ASTM D4751.

2. Permittivity: 0.05 sec^-1, minimum, when tested in accordance with ASTM D4491.

3. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM D4355/D4355M after 500 hours exposure.

4. Tensile Strength: 100 pounds-force (450 N), minimum, in cross-machine direction; 124 pounds-force (550 N), minimum, in machine direction; when tested in accordance with ASTM D4632/D4632M.

5. Elongation: 15 to 30 percent, when tested in accordance with ASTM D4632/D4632M.

6. Tear Strength: 55 pounds-force (245 N), minimum, when tested in accordance with ASTM D4533.

7. Color: Manufacturer's standard, with embedment and fastener lines preprinted.

F. Silt Fence Posts: One of the following, minimum 5 feet (1500 mm) long:

1. Steel U- or T-section, with minimum mass of 1.33 pound per linear foot (1.98 kg per linear m).

2. Hardwood, 2 by 2 inches (50 by 50 mm) in cross section.

G. Gravel: See Section 32 1123 for aggregate.

H. Riprap: See Section 31 3700.

I. Concrete: See Section 03 3000.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.02 PREPARATION

A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

3.03 SCOPE OF PREVENTIVE MEASURES

A. In all cases, if permanent erosion resistant measures have been installed temporary preventive measures are not required.

B. Construction Entrances: Traffic-bearing aggregate surface.

1. Width: As required; 20 feet (7 m), minimum.
2. Length: 50 feet (16 m), minimum.
3. Provide at each construction entrance from public right-of-way.
4. Where necessary to prevent tracking of mud onto right-of-way, provide wheel washing area out of direct traffic lane, with drain into sediment trap or basin.

C. Linear Sediment Barriers: Made of silt fences.
1. Provide linear sediment barriers:
a. Along downhill perimeter edge of disturbed areas, including soil stockpiles.
b. Along the top of the slope or top bank of drainage channels and swales that traverse disturbed areas.
c. Along the toe of cut slopes and fill slopes.
d. Perpendicular to flow across the bottom of existing and new drainage channels and swales that traverse disturbed areas or carry runoff from disturbed areas; space at maximum of 200 feet apart (at maximum of 60 m apart).
e. Across the entrances to culverts that receive runoff from disturbed areas.
2. Space sediment barriers with the following maximum slope length upslope from barrier:
a. Slope of Less Than 2 Percent: 100 feet (30 m)..
b. Slope Between 2 and 5 Percent: 75 feet (23 m).
c. Slope Between 5 and 10 Percent: 50 feet (15 m).
d. Slope Between 10 and 20 Percent: 25 feet (7.5 m).
e. Slope Over 20 Percent: 15 feet (4.5 m).

D. Storm Drain Curb Inlet Sediment Trap: Protect each curb inlet using one of the following measures:
1. Filter fabric wrapped around hollow concrete blocks blocking entire inlet face area; use one piece of fabric wrapped at least 1-1/2 times around concrete blocks and secured to prevent dislodging; orient cores of blocks so runoff passes into inlet.
2. Straw bale row blocking entire inlet face area; anchor into pavement.

E. Storm Drain Drop Inlet Sediment Traps: As detailed on drawings.

F. Temporary Splash Pads: Stone aggregate over filter fabric; size to suit application; provide at downspout outlets and storm water outlets.

G. Soil Stockpiles: Protect using one of the following measures:
1. Cover with polyethylene film, secured by placing soil on outer edges.
2. Cover with mulch at least 4 inches (100 mm) thickness of pine needles, sawdust, bark, wood chips, or shredded leaves, or 6 inches (150 mm) of straw or hay.

H. Mulching: Use only for areas that may be subjected to erosion for less than 6 months.
1. Wood Waste: Use only on slopes 3:1 or flatter; no anchoring required.

I. Temporary Seeding: Use where temporary vegetated cover is required.

3.04 INSTALLATION

A. Traffic-Bearing Aggregate Surface:

1. Excavate minimum of 6 inches (150 mm).
2. Place geotextile fabric full width and length, with minimum 12 inch (300 mm) overlap at joints.
3. Place and compact at least 6 inches (150 mm) of 1 1/2 to 3 1/2 inch (40 to 90 mm) diameter stone.

B. Silt Fences:

1. Store and handle fabric in accordance with ASTM D4873.
2. Where slope gradient is less than 3:1 or barriers will be in place less than 6 months, use nominal 16 inch (405 mm) high barriers with minimum 36 inch (905 mm) long posts spaced at 6 feet (1830 mm) maximum, with fabric embedded at least 4 inches (100 mm) in ground.
3. Where slope gradient is steeper than 3:1 or barriers will be in place over 6 months, use nominal 28 inch (710 mm) high barriers, minimum 48 inch (1220 mm) long posts spaced at 6 feet (1830 mm) maximum, with fabric embedded at least 6 inches (150 mm) in ground.
4. Where slope gradient is steeper than 3:1 and vertical height of slope between barriers is more than 20 feet (6 m), use nominal 32 inch (810 mm) high barriers with woven wire reinforcement and steel posts spaced at 4 feet (1220 mm) maximum, with fabric embedded at least 6 inches (150 mm) in ground.
5. Install with top of fabric at nominal height and embedment as specified.
6. Embed bottom of fabric in a trench on the upslope side of fence, with 2 inches (50 mm) of fabric laid flat on bottom of trench facing upslope; backfill trench and compact.
7. Do not splice fabric width; minimize splices in fabric length; splice at post only, overlapping at least 18 inches (460 mm), with extra post.
8. Fasten fabric to wood posts using one of the following:
    a. Four nails per post with 3/4 inch (19 mm) diameter flat or button head, 1 inch (25 mm) long, and 14 gage, 0.083 inch (2.11 mm) shank diameter.
    b. Five staples per post with at least 17 gage, 0.0453 inch (1.150 mm) wire, 3/4 inch (19 mm) crown width and 1/2 inch (12 mm) long legs.
9. Fasten fabric to steel posts using wire, nylon cord, or integral pockets.
10. Wherever runoff will flow around end of barrier or over the top, provide temporary splash pad or other outlet protection; at such outlets in the run of the barrier, make barrier not more than 12 inches (300 mm) high with post spacing not more than 4 feet (1220 mm).

C. Straw Bale Rows:

1. Install bales in continuous rows with ends butting tightly, with one bale at each end of row turned uphill.
2. Install bales so that bindings are not in contact with the ground.
3. Embed bales at least 4 inches (100 mm) in the ground.
4. Anchor bales with at least two stakes per bale, driven at least 18 inches (450 mm) into the ground; drive first stake in each bale toward the previously placed bale to force bales together.
5. Fill gaps between ends of bales with loose straw wedged tightly.
6. Place soil excavated for trench against bales on the upslope side of the row, compacted.

D. Mulching Over Large Areas:

1. Dry Straw and Hay: Apply 2-1/2 tons per acre (6350 kg per hectare); anchor using dull disc harrow or emulsified asphalt applied using same spraying machine at 100 gallons of water per ton of mulch.

2. Wood Waste: Apply 6 to 9 tons per acre (15,200 to 20,800 kg per hectare).
3. Erosion Control Matting: Comply with manufacturer's instructions.

E. Mulching Over Small and Medium Areas:

1. Dry Straw and Hay: Apply 4 to 6 inches (100 to 150 mm) depth.
2. Wood Waste: Apply 2 to 3inches (50 to 75 mm) depth.
3. Erosion Control Matting: Comply with manufacturer's instructions.

F. Temporary Seeding:

1. When hydraulic seeder is used, seedbed preparation is not required.
2. When surface soil has been sealed by rainfall or consists of smooth undisturbed cut slopes, and conventional or manual seeding is to be used, prepare seedbed by scarifying sufficiently to allow seed to lodge and germinate.
3. If temporary mulching was used on planting area but not removed, apply nitrogen fertilizer at 1 pound per 1000 sq ft (0.5 kg per 100 sq m).
4. On soils of very low fertility, apply 10-10-10 fertilizer at rate of 12 to 16 pounds per 1000 sq ft (6 to 8 kg per 100 sq m).
5. Incorporate fertilizer into soil before seeding.
6. Apply seed uniformly; if using drill or cultipacker seeders place seed 1/2 to 1 inch (12 to 25 mm) deep.
7. Irrigate as required to thoroughly wet soil to depth that will ensure germination, without causing runoff or erosion.
8. Repeat irrigation as required until grass is established.

3.05 MAINTENANCE

A. Inspect preventive measures weekly, within 24 hours after the end of any storm that produces 0.5 inches (13 mm) or more rainfall at the project site, and daily during prolonged rainfall.

B. Repair deficiencies immediately.

C. Silt Fences:

1. Promptly replace fabric that deteriorates unless need for fence has passed.
2. Remove silt deposits that exceed one-third of the height of the fence.
3. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.

D. Straw Bale Rows:

1. Promptly replace bales that fall apart or otherwise deteriorate unless need has passed.
2. Remove silt deposits that exceed one-half of the height of the bales.
3. Repair bale rows that are undercut by runoff or otherwise damaged, whether by runoff or other causes.

E. Clean out temporary sediment control structures weekly and relocate soil on site.

F. Place sediment in appropriate locations on site; do not remove from site.

3.06 CLEAN UP

A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Architect .

B. Clean out temporary sediment control structures that are to remain as permanent measures.

C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION

SECTION 01 5719
TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Construction procedures to promote adequate indoor air quality after construction.

B. Building flush-out after construction and before occupancy.

C. Testing indoor air quality before commencement of construction; existing building areas only.

D. Testing indoor air quality after completion of construction.

E. Testing air change effectiveness after completion of construction.

1.02 PROJECT GOALS

A. See Section 01 3329 - Sustainable Design Reporting, for overall project goals relating to environment and energy.

B. Dust and Airborne Particulates: Prevent deposition of dust and other particulates in HVAC ducts and equipment.

1. Cleaning of ductwork is not contemplated under this Contract.

2. Contractor shall bear the cost of cleaning required due to failure to protect ducts and equipment from construction dust.

C. Airborne Contaminants: Procedures and products have been specified to minimize indoor air pollutants.

1. Furnish products meeting the specifications.

2. Avoid construction practices that could result in contamination of installed products leading to indoor air pollution.

1.03 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Testing and inspection services.

B. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

C. Section 23 4000 - HVAC Air Cleaning Devices: HVAC filters.

D. Section 23 0593 - Testing, Adjusting, and Balancing for HVAC: Testing HVAC systems for proper air flow rates, adjustment of dampers and registers, and settings for equipment.

E. Section 23 0130.51 - HVAC Air-Distribution System Cleaning: Cleaning air ducts, equipment, and terminal units.

1.04 REFERENCE STANDARDS

A. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size 2017.

B. ASHRAE Std 129 - Measuring Air-Change Effectiveness. 1997 (Reaffirmed 2002).

C. ASTM D5197 - Standard Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air (Active Sampler Methodology) 2016.

D. ASTM E779 - Standard Test Method for Determining Air Leakage Rate by Fan Pressurization 2010 (Reapproved 2018).

E. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers 2017, v1.2.

F. EPA 600/4-90/010 - Compendium of Methods for the Determination of Air Pollutants in Indoor Air 1990.

G. SMACNA (OCC) - IAQ Guidelines for Occupied Buildings Under Construction 2007.

1.05 DEFINITIONS

A. Adsorptive Materials: Gypsum board, acoustical ceiling tile and panels, carpet and carpet tile, fabrics, fibrous insulation, and other similar products.

B. Contaminants: Gases, vapors, regulated pollutants, airborne mold and mildew, and the like, as specified.

C. Particulates: Dust, dirt, and other airborne solid matter.

D. Wet Work: Concrete, plaster, coatings, and other products that emit water vapor or volatile organic compounds during installation, drying, or curing.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Sustainability Documentation: Submit all submittals required in this section.

1. For LEED v4 certification system projects, submit in accordance with procedures specified in Section 01 3329.02 - Sustainable Design Reporting - LEED v4.

C. Indoor Air Quality Management Plan: Describe in detail measures to be taken to promote adequate indoor air quality upon completion; use SMACNA (OCC) as a guide.

1. Submit not less than 60 days before enclosure of building.
2. Identify potential sources of odor and dust.
3. Identify construction activities likely to produce odor or dust.
4. Identify areas of project potentially affected, especially occupied areas.
5. Evaluate potential problems by severity and describe methods of control.
6. Describe construction ventilation to be provided, including type and duration of ventilation, use of permanent HVAC systems, types of filters and schedule for replacement of filters.
7. Describe cleaning and dust control procedures.
8. Describe coordination with commissioning procedures.

D. Interior Finishes Installation Schedule: Identify each interior finish that either generates odors, moisture, or vapors or is susceptible to adsorption of odors and vapors, and indicate air handling zone, sequence of application, and curing times.

E. Duct and Terminal Unit Inspection Report.

F. Air Contaminant Test Plan: Identify:

1. Testing agency qualifications.
2. Locations and scheduling of air sampling.
3. Test procedures, in detail.
4. Test instruments and apparatus.
5. Sampling methods.

G. Air Contaminant Test Reports: Show:

1. Location where each sample was taken, and time.
2. Test values for each air sample; average the values of each set of 3.

3. HVAC operating conditions.
4. Certification of test equipment calibration.
5. Other conditions or discrepancies that might have influenced results.

H. Ventilation Effectiveness Test Plan: Identify:

1. Testing agency qualifications.
2. Description of test spaces, including locations of air sampling.
3. Test procedures, in detail; state whether tracer gas decay or step-up will be used.
4. Test instruments and apparatus; identify tracer gas to be used.
5. Sampling methods.

I. Ventilation Effectiveness Test Reports: Show:

1. Include preliminary tests of instruments and apparatus and of test spaces.
2. Calculation of ventilation effectiveness, E.
3. Location where each sample was taken, and time.
4. Test values for each air sample.
5. HVAC operating conditions.
6. Other information specified in ASHRAE Std 129.
7. Other conditions or discrepancies that might have influenced results.

1.07 QUALITY ASSURANCE

A. Testing and Inspection Agency Qualifications: Independent testing agency having minimum of 5 years experience in performing the types of testing specified.

PART 2 PRODUCTS

2.01 MATERIALS

A. Low VOC Materials: See Section 01 6116.

B. Low VOC Materials: See other sections for specific requirements for materials with low VOC content.

C. Auxiliary Air Filters: MERV of 8, minimum, when tested in accordance with ASHRAE Std 52.2.

PART 3 EXECUTION

3.01 CONSTRUCTION PROCEDURES

A. Prevent the absorption of moisture and humidity by adsorptive materials by:

1. Sequencing the delivery of such materials so that they are not present in the building until wet work is completed and dry.
2. Delivery and storage of such materials in fully sealed moisture-impermeable packaging.
3. Provide sufficient ventilation for drying within reasonable time frame.

B. Begin construction ventilation when building is substantially enclosed.

C. If extremely dusty or dirty work must be conducted inside the building, shut down HVAC systems for the duration; remove dust and dirt completely before restarting systems.

D. When working in a portion of an occupied building, prevent movement of air from construction area to occupied area.

E. HVAC equipment and supply air ductwork may be used for ventilation during construction:
   1. Operate HVAC system on 100 percent outside air, with 1.5 air changes per hour, minimum.
   2. Ensure that air filters are correctly installed prior to starting use; replace filters when they lose efficiency.
   3. Seal return air inlets or otherwise positively isolate return air system to prevent recirculation of air; provide alternate return air pathways.
   4. Where return air ducts must be used for ventilation, install auxiliary filters at return inlets, sealed to ducts; use filters with at least the equivalent efficiency as those required at supply air side; inspect and replace filters when they lose efficiency.

F. Do not store construction materials or waste in mechanical or electrical rooms.

G. Prior to use of return air ductwork without intake filters clean up and remove dust and debris generated by construction activities.
   1. Inspect duct intakes, return air grilles, and terminal units for dust.
   2. Clean plenum spaces, including top sides of lay-in ceilings, outsides of ducts, tops of pipes and conduit.
   3. Clean tops of doors and frames.
   4. Clean mechanical and electrical rooms, including tops of pipes, ducts, and conduit, equipment, and supports.
   5. Clean return plenums of air handling units.
   6. Remove intake filters last, after cleaning is complete.

H. Do not perform dusty or dirty work after starting use of return air ducts without intake filters.

I. Use other relevant recommendations of SMACNA (OCC) for avoiding unnecessary contamination due to construction procedures.

3.02 BUILDING FLUSH-OUT

A. Contractor 's Option: Either full continuous flush-out OR satisfactory air contaminant testing is required, not both.

B. Perform building flush-out before occupancy.

C. Do not start flush-out until:
   1. All construction is complete.
   2. HVAC systems have been tested, adjusted, and balanced for proper operation.
   3. Cleaning of inside of HVAC ductwork, specified elsewhere, has been completed.
   4. Inspection of inside of return air ducts and terminal units confirms that cleaning is not necessary.
   5. New HVAC filtration media have been installed.

D. Building Flush-Out: Operate all ventilation systems at normal flow rates with 100 percent outside air until a total air volume of 14,000 cubic feet per square foot (4500 cubic meters per square meter) of floor area has been supplied.
   1. Obtain Owner 's concurrence that construction is complete enough before beginning flush-out.
   2. Maintain interior temperature of at least 60 degrees F (15 degrees C) and interior relative humidity no higher than 60 percent.

3. If additional construction involving materials that produce particulates or any of the specified contaminants is conducted during flush-out, start flush-out over.

E. Install new HVAC filtration media after completion of flush-out and before occupancy or further testing.

3.03 AIR CONTAMINANT TESTING

A. Contractor's Option: Either full continuous flush-out, or satisfactory air contaminant testing is required, not both.

B. Perform air contaminant testing before starting construction, as base line for evaluation of post-construction testing.

C. Perform air contaminant testing before occupancy.

D. Do not start air contaminant testing until:

1. All construction is complete, including interior finishes.
2. HVAC systems have been tested, adjusted, and balanced for proper operation.
3. Cleaning of inside of HVAC ductwork, specified elsewhere, has been completed.
4. New HVAC filtration media have been installed.

E. Indoor Air Samples: Collect from spaces representative of occupied areas:

1. Collect samples while operable windows and exterior doors are closed, HVAC system is running normally as if occupied, with design minimum outdoor air, but with the building unoccupied.
2. Collect samples from spaces in each contiguous floor area in each air handler zone, but not less than one sample per 25,000 square feet (2300 square meters); take samples from areas having the least ventilation and those having the greatest presumed source strength.
3. Collect samples from height from 36 inches (915 mm) to 72 inches (1830 mm) above floor.
4. Collect samples from same locations on 3 consecutive days during normal business hours; average the results of each set of 3 samples.
5. Exception: Areas with normal very high outside air ventilation rates, such as laboratories, do not need to be tested.
6. When retesting the same building areas, take samples from at least the same locations as in first test.

F. Outdoor Air Samples: Collect samples at outside air intake of each air handler at the same time as indoor samples are taken.

G. Analyze air samples and submit report.

H. Air Contaminant Concentration Limits:

1. Formaldehyde: Not more than 27 parts per billion.
2. PM10 Particulates: Not more than 50 micrograms per cubic meter.
3. Total Volatile Organic Compounds (TVOCs): Not more than 500 micrograms per cubic meter.
4. Chemicals Listed in CAL (CDPH SM) Table 4-1, except Formaldehyde: Allowable concentrations listed in Table 4-1.
5. Carbon Monoxide: Not more than 9 parts per million and not more than 2 parts per million higher than outdoor air.

I. Air Contaminant Concentration Test Methods:

1. Formaldehyde: ASTM D5197, EPA 625/R-96/010b Method TO-11A, or EPA 600/4-90/010 Method IP-6.
2. Particulates: EPA 600/4-90/010 Method IP-10.
3. Total Volatile Organic Compounds (TVOC): EPA 625/R-96/010b Method TO-1, TO-15, or TO-17; or EPA 600/4-90/010 Method IP-1.
4. Chemicals Listed in CAL (CDPH SM) Table 4-1, except Formaldehyde: ASTM D5197, or EPA 625/R-96/010b Method TO-1, TO-15, or TO-17.
5. Carbon Monoxide: EPA 600/4-90/010 Method IP-3, plus measure outdoor air; measure in ppm; report both indoor and outdoor measurements.

J. If air samples show concentrations higher than those specified, ventilate with 100 percent outside air and retest at no cost to Owner , or conduct full building flush-out specified above.

3.04 VENTILATION EFFECTIVENESS TESTING

A. Perform ventilation effectiveness testing before occupancy.

B. Do not begin ventilation effectiveness testing until:

1. HVAC testing, adjusting, and balancing has been satisfactorily completed.
2. Building flush-out or air contaminant testing has been completed satisfactorily.
3. New HVAC filtration media have been installed.

C. Test each air handler zone in accordance with ASHRAE Std 129.

D. If calculated air change effectiveness for a particular zone is less than 0.9 due to inadequate balancing of the system, adjust, and retest at no cost to Owner .

END OF SECTION

SECTION 01 5813
TEMPORARY PROJECT SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project identification sign.

B. Project informational signs.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Responsibility to provide signs.

1.03 QUALITY ASSURANCE

A. Design sign and structure to withstand 50 miles/hr (80 km/hr) wind velocity.

B. Sign Painter: Experienced as a professional sign painter for minimum three years.

C. Finishes, Painting: Adequate to withstand weathering, fading, and chipping for duration of construction.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawing: Show content, layout, lettering, color, foundation, structure, sizes and grades of members.

PART 2 PRODUCTS

2.01 SIGN MATERIALS

A. Sign Surfaces: Exterior grade plywood with medium density overlay, minimum 3/4 inch (19 mm) thick, standard large sizes to minimize joints.

B. Paint and Primers: Exterior quality, two coats; sign background of white color.

C. Lettering: Exterior quality paint, contrasting colors.

2.02 PROJECT IDENTIFICATION SIGN

A. One painted sign of construction, design, and content indicated on drawings, location designated.

B. Content:

1. Project number, title, logo and name of Owner as indicated on Contract Documents.
2. Names and titles of authorities.
3. Names and titles of Architect and Consultants.
4. Name of Prime Contractor and major Subcontractors.

C. PGCPS has directive on how to execute the signage for all types of project. This documentation will be incorproated in the drawings and specifications.

2.03 PROJECT INFORMATIONAL SIGNS

A. Painted informational signs of same colors and lettering as Project Identification sign, or standard products; size lettering to provide legibility at 100 foot (30 m) distance.

B. Provide at each field office, storage shed , and directional signs to direct traffic into and within site. Relocate as Work progress requires.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install project identification sign within 30 days after date fixed by Notice to Proceed.

B. Erect at designated location.

C. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.

D. Install sign surface plumb and level, with butt joints. Anchor securely.

E. Paint exposed surfaces of sign, supports, and framing.

3.02 MAINTENANCE

A. Maintain signs and supports clean, repair deterioration and damage.

3.03 REMOVAL

A. Remove signs, framing, supports, and foundations at completion of Project and restore the area.

END OF SECTION

INTERAGENCY COMMISSION ON SCHOOL CONSTRUCTION

LARRY HOGAN
GOVERNOR

KAREN SALMON, PhD.
CHAIRPERSON

ROBERT A. GORRELL
EXECUTIVE DIRECTOR

200 WEST BALTIMORE STREET
BALTIMORE, MD 21201
410-767-0617

WWW.PSCP.STATE.MD.US

PSCP.MSDE@MARYLAND.GOV

MEMORANDUM

TO: **All Directors of Facility Planning**
All Directors of Maintenance

FROM: **Robert A. Gorrell, Executive Director**

DATE: **June 5, 2019** RAG

RE: **Revision for Construction Sign**

Each State funded school construction project shall have a construction sign on the site and a plaque for installation in the school as identified in Appendix E of the IAC/PSCP Administrative Procedures Guide (APG).

On May 1, 2019, Speaker Adrienne A. Jones was sworn in as Speaker of the House, resulting in revisions to the construction sign for State funded school construction projects. This revised sign is available through Maryland Correctional Enterprises (MCE) and should be used for State funded school construction projects. Replacement labels are available as well and may be adhered to existing signs in lieu of replacement signs.

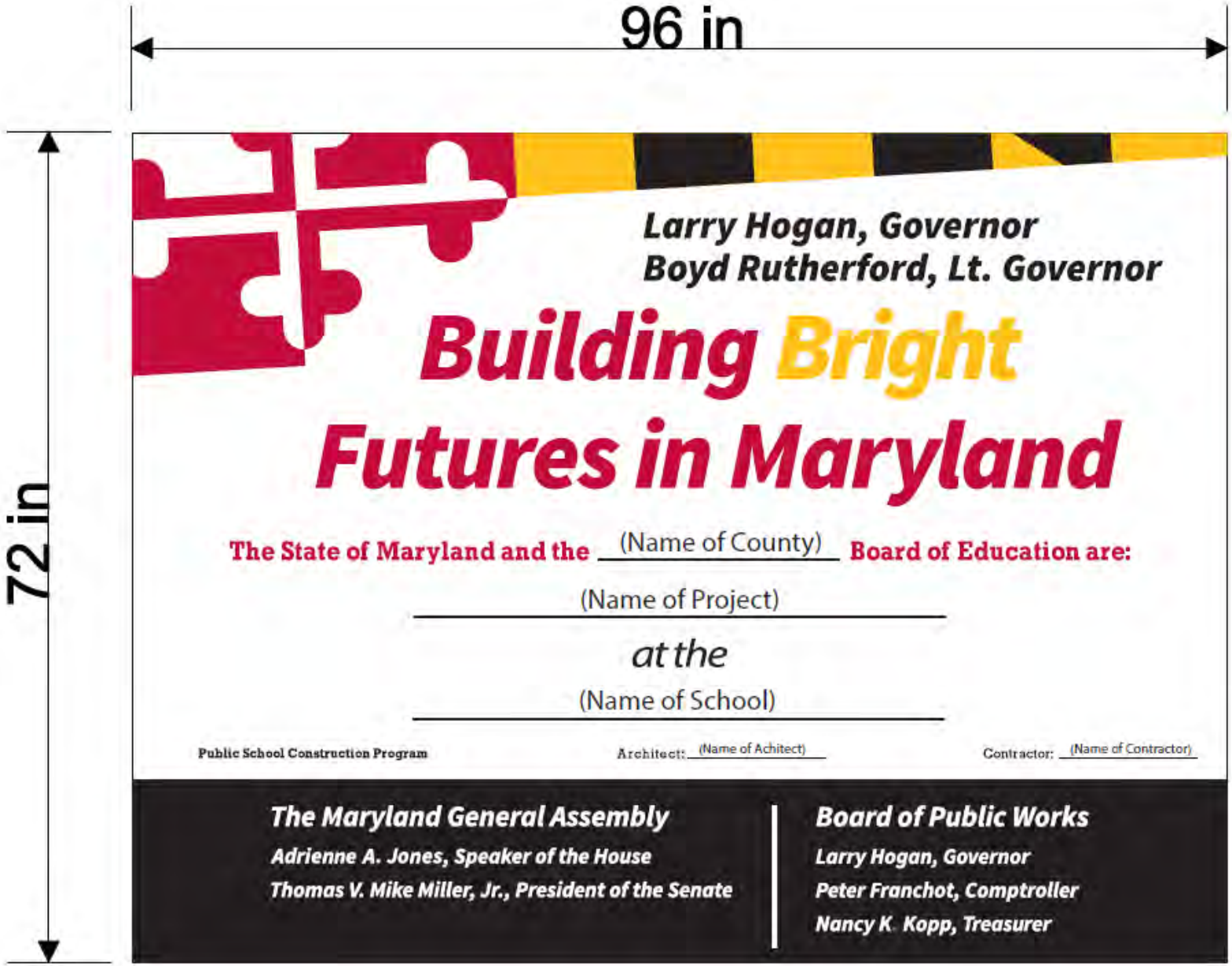
The construction sign should be erected for all State funded school construction projects including all systemic renovation projects, with the exception of Aging School Program (ASP) and Qualified Zone Academy Bond (QZAB) projects less than $100,000 and State-owned and locally-owned relocatable classroom building projects. This policy is consistent with the requirements of the IAC Administrative Procedures Guide (APG).

Please ensure that the new layout is followed exactly as sent to you, including the same slogan, names, colors, justification, size of lettering, etc. It is strongly recommended that construction signs be purchased through MCE.
MCE can be reached at:

Maryland Correctional Enterprises (MCE) Sign Plant #111
C/O Patuxent Institution
Attention: Charles Behnke, Plant Manager
7555 Waterloo Road Jessup, MD 20794
410-799-5102 - FAX: 410-499-7911
cwbehnke@dpscs.state.md.us
www.mce.md.gov

Please reference the enclosed revised pages until the Administrative Procedures Guide is updated with the revised information and review this information with your project architects, contractors and consultants.
If you have any questions regarding his matter, please contact Melissa Wies at Melissa.wies@maryland.gov or (410) 767-4656.
RG:mw

Enclosures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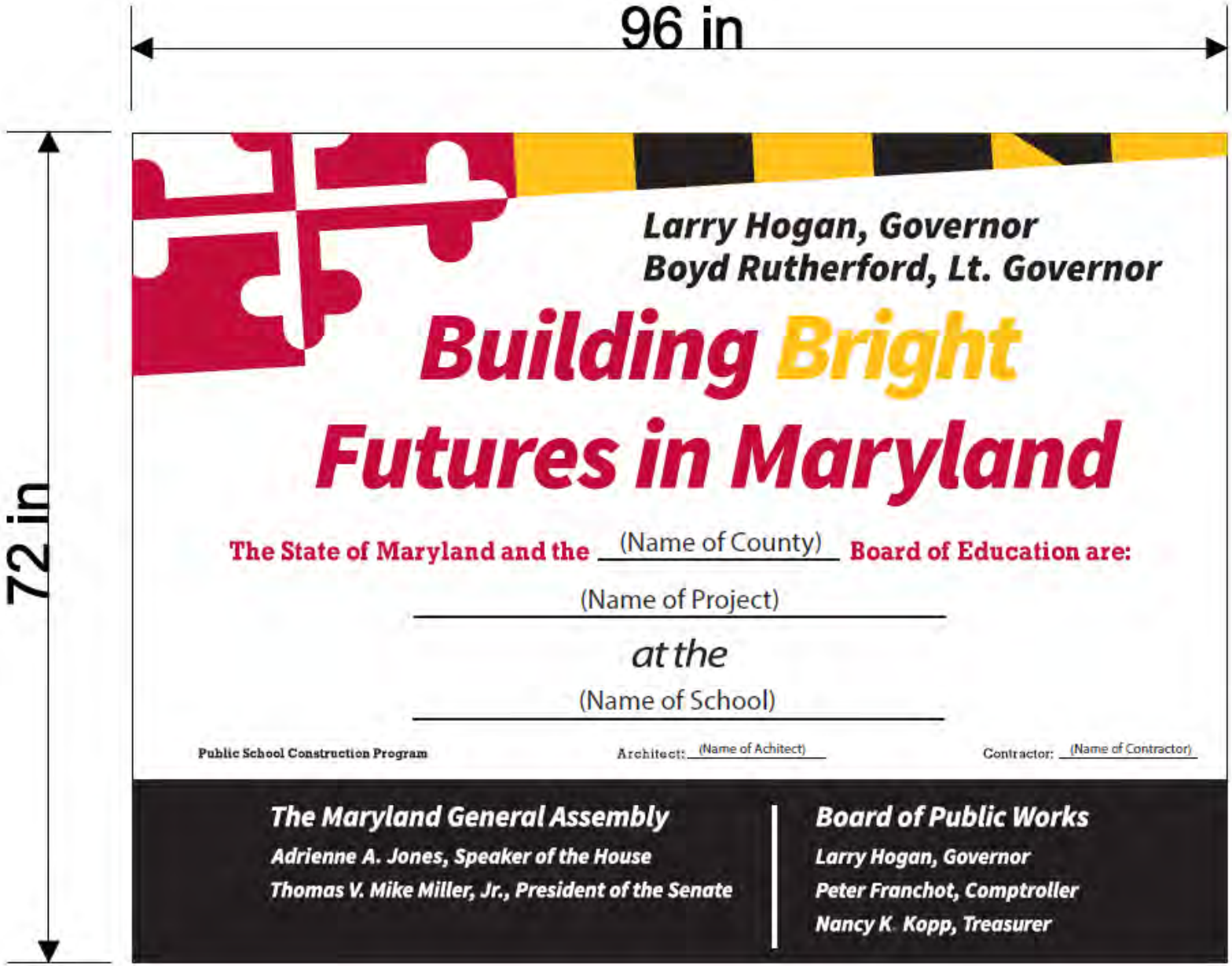
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SECTION 01600 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

1.2 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
   3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

D. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

E. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer’s warranty or to provide more rights for Owner.

1.3 SUBMITTALS

A. Product List: Submit a list, in tabular from, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.
   1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
   2. Form: Tabulate information for each product under the following column headings:
      a. Specification Section number and title.
      b. Generic name used in the Contract Documents.
      c. Proprietary name, model number, and similar designations.
      d. Manufacturer's name and address.

e. Supplier's name and address.
f. Installer's name and address.
g. Projected delivery date or time span of delivery period.
h. Identification of items that require early submittal approval for scheduled delivery date.

3. Initial Submittal: Within 14 calendar days after the Notice to Proceed (NTP), submit 3 copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.
   a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.
4. Completed List: Within 28 calendar days after the Notice to Proceed (NTP), submit 3 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
5. Design Consultant Action: The Design Consultant will respond in writing to Contractor 14 calendar days of receipt of completed product list. The Design Consultant's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. The Design Consultant's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.

B. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Substitution Request Form: Use CSI Form 13.1A.
   2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
      a. Statement indicating why specified material or product cannot be provided.
      b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
      c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
      d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
      e. Samples, where applicable or requested.
      f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
      g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
      h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
      i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
      j. Cost information, including a proposal of change, if any, in the Contract Sum.
      k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
      l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
   3. Design Consultant Action: If necessary, the Design Consultant will request additional information or documentation for evaluation within 7 calendar days of receipt of a request for substitution. The Design Consultant will notify Contractor through Construction Manager of acceptance or rejection of proposed substitution within 15 calendar days of

receipt of request, or 7 calendar days of receipt of additional information or documentation, whichever is later.
    a. Form of Acceptance: Change Order.
    b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.

C. Comparable Product Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
    1. Design Consultant Action: If necessary, the Design Consultant will request additional information or documentation for evaluation within 7 calendar days of receipt of a comparable product request. The Design Consultant will notify Contractor through Construction Manager of approval or rejection of proposed comparable product request within 15 calendar days of receipt of request, or 7 calendar days of receipt of additional information or documentation, whichever is later.
        a. Form of Approval: As specified in Division 1 Section "Submittal Procedures."
        b. Use product specified if Architect cannot make a decision on use of a comparable product request within time allocated.

D. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 1 Section "Submittal Procedures." Show compliance with requirements.

1.4 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.
    1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
    2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

B. Delivery and Handling:
    1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
    2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
    3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
    4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.

C. Storage:
    1. Store products to allow for inspection and measurement of quantity or counting of units.
    2. Store materials in a manner that will not endanger Project structure.
    3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
    4. Store cementitious products and materials on elevated platforms.

5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.
9. Materials paid by Owner and stored off-site, the items must be stored in a bonded storage facility and insured with the Owner named as the insured. If the material is to be located beyond 25 miles of the construction site the contractor must provide transportation for the Owners representative to visit the storage site for material verification. Materials must be clearly marked as property of the Owner, including project name.

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
   1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner. Provide Manufacturer's Warranty for all items specified in the Contract Documents including items not identified specifically to receive Warranties. Warranty period shall be consistent with industry standards and shall be for manufactures maximum duration offered.
   2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
   1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
   2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
   3. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 1 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.
   1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
   2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
   3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
   4. Where products are accompanied by the term "as selected," the Design Consultant will make selection.

5. Where products are accompanied by the term "match sample," sample to be matched is the Design Consultant's.
6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in Part 2 "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:
1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
6. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
7. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.
8. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers.
9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
    a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.
10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.
    a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
    b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 PRODUCT SUBSTITUTIONS

A. Timing: The Contractor may submit substitutions anytime within a 45 calendar day period after Notice to Proceed. Substitutions will be considered and reviewed by the Design Consultant who will make an acceptance or rejection recommendation to BCPS. The burden of proof of

equivalency rests with the Contractor and evidence of such equivalency shall be submitted to the Design Consultant.

B. Conditions: The Design Consultant will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, the Design Consultant will return requests without action, except to record noncompliance with these requirements:
   1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
   2. Requested substitution does not require extensive revisions to the Contract Documents.
   3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
   4. Substitution request is fully documented and properly submitted.
   5. Requested substitution will not adversely affect Contractor's Construction Schedule.
   6. Requested substitution has received necessary approvals of authorities having jurisdiction.
   7. Requested substitution is compatible with other portions of the Work.
   8. Requested substitution has been coordinated with other portions of the Work.
   9. Requested substitution provides specified warranty.
   10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

2.3 COMPARABLE PRODUCTS

A. Conditions: The Design Consultant will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, the Design Consultant will return requests without action, except to record noncompliance with these requirements:
   1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
   2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
   3. Evidence that proposed product provides specified warranty.
   4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
   5. Samples, if requested.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 6116
VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for Indoor-Emissions-Restricted products.

B. Requirements for VOC-Content-Restricted products.

C. Requirement for installer certification that they did not use any non-compliant products.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittal procedures.

B. Section 01 3329.02 - Sustainable Design Reporting - LEED v4: Procedures for reporting emissions and VOC content data.

C. Section 01 3329.04 - Material Content Form: Form for reporting emissions and VOC content.

D. Section 01 3329.07 - Prohibited Content Installer Certification: Form for certifying that no non-compliant products were used.

E. Section 01 4000 - Quality Requirements: Procedures for testing and certifications.

F. Section 01 5719 - Temporary Environmental Controls: Procedures and testing.

G. Section 01 6000 - Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.

H. Section 07 9200 - Joint Sealants: Emissions-compliant sealants.

1.03 DEFINITIONS

A. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:

1. Interior paints and coatings applied on site.
2. Interior adhesives and sealants applied on site, including flooring adhesives.
3. Flooring.
4. Composite wood.
5. Products making up wall and ceiling assemblies.
6. Thermal and acoustical insulation.
7. Free-standing furniture.
8. Exterior applied products (for Healthcare and Schools projects only).
9. Other products when specifically stated in the specifications.

B. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:

1. Interior paints and coatings applied on site.
2. Interior adhesives and sealants applied on site, including flooring adhesives.
3. Wet-applied roofing and waterproofing.
4. Other products when specifically stated in the specifications.

C. Interior of Building: Anywhere inside the exterior weather barrier.

D. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.

E. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.

F. Inherently Non-Emitting Materials: Products composed wholly of minerals or metals, unless they include organic-based surface coatings, binders, or sealants; and specifically the following:

1. Concrete.
2. Clay brick.
3. Metals that are plated, anodized, or powder-coated.
4. Glass.
5. Ceramics.
6. Solid wood flooring that is unfinished and untreated.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.

B. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings 2005 (Reapproved 2013).

C. BIFMA e3 - Furniture Sustainability Standard; Business and Institutional Furniture Manufacturers Association 2014.

D. BIFMA M7.1 - Standard Test Method for Determining VOC Emissions from Office Furniture Systems, Components, and Seating 2011 (Reapproved 2016).

E. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers 2017, v1.2.

F. CARB (ATCM) - Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products; California Air Resources Board current edition.

G. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board 2007.

H. CHPS (HPPD) - High Performance Products Database Current Edition at www.chps.net/.

I. CRI (GLP) - Green Label Plus Testing Program - Certified Products Current Edition.

J. GreenSeal GS-36 - Adhesives for Commercial Use 2013.

K. SCAQMD 1113 - Architectural Coatings 1977 (Amended 2016).

L. SCAQMD 1168 - Adhesive and Sealant Applications 1989 (Amended 2017).

M. SCS (CPD) - SCS Certified Products Current Edition.

N. UL (GGG) - GREENGUARD Gold Certified Products Current Edition.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.

C. Sustainable Design Reporting: Submit evidence of compliance.

1. Refer to Section 01 3329.02 - Sustainable Design Reporting - LEED v4.

D. Installer Certifications Regarding Prohibited Content: Require each installer of any type of product (not just the products for which VOC restrictions are specified) to certify that either 1) no adhesives, joint sealants, paints, coatings, or composite wood or agrifiber products have been used in the installation of installer's products, or 2) that such products used comply with these requirements.

1.06 QUALITY ASSURANCE

A. Indoor Emissions Standard and Test Method: CAL (CDPH SM), using Standard Private Office exposure scenario and the allowable concentrations specified in the method, and range of total VOC's after 14 days.

1. Wet-Applied Products: State amount applied in mass per surface area.
2. Paints and Coatings: Test tinted products, not just tinting bases.
3. Evidence of Compliance: Acceptable types of evidence are the following;
    a. Current UL (GGG) certification.
    b. Current SCS (CPD) Floorscore certification.
    c. Current SCS (CPD) Indoor Advantage Gold certification.
    d. Current listing in CHPS (HPPD) as a low-emitting product.
    e. Current CRI (GLP) certification.
    f. Test report showing compliance and stating exposure scenario used.
4. Product data submittal showing VOC content is NOT acceptable evidence.
5. Manufacturer's certification without test report by independent agency is NOT acceptable evidence.

B. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.

1. Evidence of Compliance: Acceptable types of evidence are:
    a. Report of laboratory testing performed in accordance with requirements.
    b. Published product data showing compliance with requirements.
    c. Certification by manufacturer that product complies with requirements.

C. Composite Wood Emissions Standard: CARB (ATCM) for ultra-low emitting formaldehyde (ULEF) resins.

1. Evidence of Compliance: Acceptable types of evidence are:
    a. Current SCS "No Added Formaldehyde (NAF)" certification; www.scscertified.com.
    b. Report of laboratory testing performed in accordance with requirements.
    c. Published product data showing compliance with requirements.
    d. Certification by manufacturer that product complies with requirements.

D. Furnishings Emissions Standard and Test Method: BIFMA e3 Sections 7.6.1 and 7.6.2, tested in accordance with BIFMA M7.1.

1. Evidence of Compliance:
    a. Test report showing compliance and stating exposure scenario used.

E. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.01 MATERIALS

A. All Products: Comply with the most stringent of federal, State, and local requirements, or these specifications.

B. Indoor-Emissions-Restricted Products: Comply with Indoor Emissions Standard and Test Method, except for:

1. Composite Wood, Wood Fiber, and Wood Chip Products: Comply with Composite Wood Emissions Standard or contain no added formaldehyde resins.
2. Furnishings: Comply with Furnishings Emissions Standard and Test Method.
3. Inherently Non-Emitting Materials.

C. VOC-Content-Restricted Products: VOC content not greater than required by the following:

1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.
2. Aerosol Adhesives: GreenSeal GS-36.
3. Joint Sealants: SCAQMD 1168 Rule.
4. Paints and Coatings: Each color; most stringent of the following:
    a. 40 CFR 59, Subpart D.
    b. SCAQMD 1113 Rule.
    c. CARB (SCM).
5. Wet-Applied Roofing and Waterproofing: Comply with requirements for paints and coatings.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Owner .

B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

END OF SECTION

SECTION 01 7000
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Requirements for alterations work, including selective demolition.

C. Pre-installation meetings.

D. Cutting and patching.

E. Surveying for laying out the work.

F. Cleaning and protection.

G. Starting of systems and equipment.

H. Demonstration and instruction of Owner personnel.

I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

J. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.

B. Section 01 3000 - Administrative Requirements: Submittals procedures, Electronic document submittal service.

C. Section 01 4000 - Quality Requirements: Testing and inspection procedures.

D. Section 01 5000 - Temporary Facilities and Controls: Temporary exterior enclosures.

E. Section 01 5000 - Temporary Facilities and Controls: Temporary interior partitions.

F. Section 01 5100 - Temporary Utilities: Temporary heating, cooling, and ventilating facilities.

G. Section 01 5713 - Temporary Erosion and Sediment Control: Additional erosion and sedimentation control requirements.

H. Section 01 7419 - Construction Waste Management and Disposal: Additional procedures for trash/waste removal, recycling, salvage, and reuse.

I. Section 4600 - 4600: Materials for protection of installed work.

J. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.

K. Section 01 7900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

L. Section 01 9113 - General Commissioning Requirements: Contractor's responsibilities in regard to commissioning.

M. Section 02 4100 - Demolition: Demolition of whole structures and parts thereof; site utility demolition.

N. Section 02 8400 - Polychlorinate Biphenyl (PCB) Remediation: Removal of equipment containing substances regulated under the Federal Toxic Substances Control Act (TSCA), including but not limited to PCB- and mercury-containing equipment.

O. Section 07 8400 - Firestopping.

P. Individual Product Specification Sections:

1. Limitations on cutting structural members.

1.03 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations 2013.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.

1. On request, submit documentation verifying accuracy of survey work.
2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
3. Submit surveys and survey logs for the project record.

C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.

1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences. Include design drawings and calculations for bracing and shoring.
2. Identify demolition firm and submit qualifications.
3. Include a summary of safety procedures.

D. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:

1. Structural integrity of any element of Project.
2. Integrity of weather exposed or moisture resistant element.
3. Efficiency, maintenance, or safety of any operational element.
4. Visual qualities of sight exposed elements.
5. Work of Owner or separate Contractor.
6. Include in request:
    a. Identification of Project.
    b. Location and description of affected work.
    c. Necessity for cutting or alteration.
    d. Description of proposed work and products to be used.
    e. Effect on work of Owner or separate Contractor.
    f. Written permission of affected separate Contractor.
    g. Date and time work will be executed.

1.05 QUALIFICATIONS

A. For demolition work, employ a firm specializing in the type of work required.

1. Minimum of five years of documented experience.

B. For surveying work, employ a land surveyor registered in Maryland and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

C. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in Maryland.

1.06 PROJECT CONDITIONS

A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

C. Perform dewatering activities, as required, for the duration of the project.

D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

E. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.

1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.
2. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner .

F. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.

1. Minimize amount of bare soil exposed at one time.
2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

G. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

1. At All Times: Excessively noisy tools and operations will not be tolerated inside the building at any time of day; excessively noisy includes jackhammers.
2. Outdoors: Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm.
3. Indoors: Limit conduct of especially noisy interior work to the hours of 6 pm to 7 am.

H. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

I. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

J. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.07 COORDINATION

A. See Section 01 1000 for occupancy-related requirements.

B. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

C. Notify affected utility companies and comply with their requirements.

D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

G. Coordinate completion and clean-up of work of separate sections.

H. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner 's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Architect four days in advance of meeting date.

D. Prepare agenda and preside at meeting:

1. Review conditions of examination, preparation and installation procedures.

2. Review coordination with related work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect , Owner , participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Contractor shall locate and protect survey control and reference points.

D. Control datum for survey is that established by Owner provided survey.

E. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

F. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

G. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect .

H. Utilize recognized engineering survey practices.

I. Establish a minimum of two permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.

J. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:

1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.

2. Grid or axis for structures.

3. Building foundation, column locations, ground floor elevations.

4. Controlling lines and levels required for mechanical and electrical trades.

K. Periodically verify layouts by same means.

L. Maintain a complete and accurate log of control and survey work as it progresses.

M. On completion of foundation walls and major site improvements, prepare a certified survey illustrating dimensions, locations, angles, and elevations of construction and site work.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. In addition to compliance with regulatory requirements, conduct construction operations in compliance with NFPA 241, including applicable recommendations in Appendix A.

B. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

C. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

D. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

E. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

F. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.

1. Verify that construction and utility arrangements are as indicated.
2. Report discrepancies to Architect before disturbing existing installation.
3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.

1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 5000 in locations indicated on drawings.
2. Provide sound retardant partitions of construction indicated on drawings in locations indicated on drawings.

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.

1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.

D. Remove existing work as indicated and as required to accomplish new work.

1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
2. Remove items indicated on drawings.
3. Relocate items indicated on drawings.
4. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
5. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, Telecommunications and Building Automation Systems): Remove, relocate, and extend existing systems to accommodate new construction.

1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.

a. Disable existing systems only to make switchovers and connections; minimize duration of outages.

b. See Section 01 1000 for other limitations on outages and required notifications.

c. Provide temporary connections as required to maintain existing systems in service.

4. Verify that abandoned services serve only abandoned facilities.

5. Remove abandoned pipe, ducts, conduits, and equipment , including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

F. Protect existing work to remain.

1. Prevent movement of structure; provide shoring and bracing if necessary.

2. Perform cutting to accomplish removals neatly and as specified for cutting new work.

3. Repair adjacent construction and finishes damaged during removal work.

G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.

1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect .

2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.

3. Where a change of plane of 1/4 inch (6 mm) or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.

4. Trim existing wood doors as necessary to clear new floor finish. Refinish trim as required.

H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

I. Refinish existing surfaces as indicated:

1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.

2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

J. Clean existing systems and equipment.

K. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

L. Do not begin new construction in alterations areas before demolition is complete.

M. Comply with all other applicable requirements of this section.

3.07 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. Perform whatever cutting and patching is necessary to:

1. Complete the work.

2. Fit products together to integrate with other work.
3. Provide openings for penetration of mechanical, electrical, and other services.
4. Match work that has been cut to adjacent work.
5. Repair areas adjacent to cuts to required condition.
6. Repair new work damaged by subsequent work.
7. Remove samples of installed work for testing when requested.
8. Remove and replace defective and non-complying work.

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.

J. Patching:

1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
2. Match color, texture, and appearance.
3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.08 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.09 PROTECTION OF INSTALLED WORK

A. See Section 01 7610 for temporary protective covering materials.

B. Protect installed work from damage by construction operations.

C. Provide special protection where specified in individual specification sections.

D. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

E. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

F. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

G. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace protective coverings.

H. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

I. Prohibit traffic from landscaped areas.

J. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.10 SYSTEM STARTUP

A. Coordinate with requirements of Section 01 9113 - General Commissioning Requirements.

B. Coordinate schedule for start-up of various equipment and systems.

C. Notify Architect and Owner seven days prior to start-up of each item.

D. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

E. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

F. Verify that wiring and support components for equipment are complete and tested.

G. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

H. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

I. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

A. See Section 01 7900 - Demonstration and Training.

3.12 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

B. Testing, adjusting, and balancing HVAC systems: See Section 23 0593 - Testing, Adjusting, and Balancing for HVAC.

3.13 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.

1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.

B. Use cleaning materials that are nonhazardous.

C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

F. Clean filters of operating equipment.

G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, drainage systems and [_____].

H. Clean site; sweep paved areas, rake clean landscaped surfaces.

I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.14 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.

1. Provide copies to Architect and Owner .

B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.

C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.

D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

E. Owner will occupy all of the building as specified in Section 01 1000.

F. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

G. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

H. Accompany Project Coordinator on Contractor's preliminary final inspection.

I. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

J. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.15 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner .

END OF SECTION

SECTION 01 7419
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

A. Owner requires that this project generate the least amount of trash and waste possible.

B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

D. Owner may decide to pay for additional recycling, salvage, and/or reuse based on Landfill Alternatives Proposal specified below.

E. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:

1. Aluminum and plastic beverage containers.
2. Corrugated cardboard.
3. Wood pallets.
4. Clean dimensional wood.
5. Land clearing debris, including brush, branches, logs, and stumps; see Section 31 1000 - Site Clearing for use options.
6. Concrete: May be crushed and used as riprap, aggregate, sub-base material, or fill.
7. Bricks: May be used on project if whole, or crushed and used as landscape cover, sub-base material, or fill.
8. Concrete masonry units: May be used on project if whole, or crushed and used as sub-base material or fill.
9. Precast concrete panels: May be used for erosion control or landscape features.
10. Asphalt paving: May be recycled into paving for project.
11. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
12. Glass.
13. Gypsum drywall and plaster.
14. Plastic buckets.
15. Carpet, carpet cushion, carpet tile, and carpet remnants, both new and removed: DuPont (http://flooring.dupont.com) and Interface (www.interfaceinc.com) conduct reclamation programs.
16. Asphalt roofing shingles.
17. Paint.
18. Plastic sheeting.
19. Rigid foam insulation.
20. Vinyl siding.

21. Windows, doors, and door hardware.
22. Plumbing fixtures.
23. Mechanical and electrical equipment.
24. Fluorescent lamps (light bulbs).
25. Acoustical ceiling tile and panels.

F. The following recycling incentive programs are mandatory for this project; Contractor is responsible for implementation:

1. Rebates and credits must be applied for by Owner and shall accrue to Owner .

G. Owner has made arrangements for salvage of the following materials by others:

H. Contractor shall submit periodic Waste Disposal Reports; all landfill disposal, incineration, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports.

I. Contractor shall develop and follow a Waste Management Plan designed to implement these requirements.

J. The following sources may be useful in developing the Waste Management Plan:

1. Recycling Haulers and Markets: The attached list contains local haulers and markets for recyclable materials. This list is provided for information only and is not necessarily comprehensive; other haulers and markets are acceptable.

K. Methods of trash/waste disposal that are not acceptable are:

1. Burning on the project site.
2. Burying on the project site.
3. Dumping or burying on other property, public or private.
4. Other illegal dumping or burying.

L. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: List of items to be salvaged from the existing building for relocation in project or for Owner.

B. Section 01 3000 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.

C. Section 01 5000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.

D. Section 01 6000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.

E. Section 01 7000 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

F. Section 31 1000 - Site Clearing: Handling and disposal of land clearing debris.

1.03 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.

D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

I. Return: To give back reusable items or unused products to vendors for credit.

J. Reuse: To reuse a construction waste material in some manner on the project site.

K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

N. Toxic: Poisonous to humans either immediately or after a long period of exposure.

O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Sustainable Design Submittals: Submit Waste Management Plan and Waste Disposal Reports in accordance with procedures specified in Section 01 3566.13 - Sustainability Certification Project Procedures - Green Globes.

C. Landfill Alternatives Proposal: Within 10 calendar days after receipt of Notice of Award of Bid, or prior to any trash or waste removal, whichever occurs sooner, submit a projection of trash/waste that will require disposal and alternatives to landfilling, with net costs.

1. Submit to Architect for Owner 's review and approval.

2. If Owner wishes to implement any cost alternatives, the Contract Sum will be adjusted as specified elsewhere.

3. Include an analysis of trash/waste to be generated and landfill options as specified for Waste Management Plan described below.

4. Describe as many alternatives to landfilling as possible:

a. List each material proposed to be salvaged, reused, or recycled.

b. List the proposed local market for each material.

c. State the estimated net cost resulting from each alternative, after subtracting revenue from sale of recycled or salvaged materials and landfill tipping fees saved due to diversion of materials from the landfill.

5. Provide alternatives to landfilling for at least the following materials:

a. Aluminum and plastic beverage containers.

b. Corrugated cardboard.

c. Wood pallets.

d. Clean dimensional wood.

e. Land clearing debris, including brush, branches, logs, and stumps.

f. Concrete.

g. Bricks.

h. Concrete masonry units.

i. Asphalt paving.

j. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.

D. Once Owner has determined which of the landfill alternatives addressed in the Proposal above are acceptable, prepare and submit Waste Management Plan; submit within 10 calendar days after notification by Architect .

E. Waste Management Plan: Include the following information:

1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.

2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).

3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.

a. List each material proposed to be salvaged, reused, or recycled.

b. List the local market for each material.

c. State the estimated net cost, versus landfill disposal.

4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.

5. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.

6. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.

7. Recycling Incentives: Describe procedures required to obtain credits, rebates, or similar incentives.

F. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.

1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
2. Submit Report on a form acceptable to Owner .
3. Landfill Disposal: Include the following information:
    a. Identification of material.
    b. Amount, in tons or cubic yards (cubic meters), of trash/waste material from the project disposed of in landfills.
    c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
    d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
4. Incinerator Disposal: Include the following information:
    a. Identification of material.
    b. Amount, in tons or cubic yards (cubic meters), of trash/waste material from the project delivered to incinerators.
    c. State the identity of incinerators, total amount of fees paid to incinerator, and total disposal cost.
    d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
5. Recycled and Salvaged Materials: Include the following information for each:
    a. Identification of material, including those retrieved by installer for use on other projects.
    b. Amount, in tons or cubic yards (cubic meters), date removed from the project site, and receiving party.
    c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
    d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
    e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
6. Material Reused on Project: Include the following information for each:
    a. Identification of material and how it was used in the project.
    b. Amount, in tons or cubic yards (cubic meters).
    c. Include weight tickets as evidence of quantity.
7. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

G. Recycling Incentive Programs:
1. Where revenue accrues to Contractor, submit copies of documentation required to qualify for incentive.
2. Where revenue accrues to Owner, submit any additional documentation required by Owner in addition to information provided in periodic Waste Disposal Report.

PART 2 PRODUCTS

2.01 PRODUCT SUBSTITUTIONS

A. See Section 01 6000 - Product Requirements for substitution submission procedures.

B. For each proposed product substitution, submit the following information in addition to requirements specified in Section 01 6000:

1. Relative amount of waste produced, compared to specified product.
2. Cost savings on waste disposal, compared to specified product, to be deducted from the Contract Sum.
3. Proposed disposal method for waste product.
4. Markets for recycled waste product.

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

A. See Section 01 3000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.

B. See Section 01 5000 for additional requirements related to trash/waste collection and removal facilities and services.

C. See Section 01 6000 for waste prevention requirements related to delivery, storage, and handling.

D. See Section 01 7000 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.

B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner , and Architect .

C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

D. Meetings: Discuss trash/waste management goals and issues at project meetings.

1. Prebid meeting.
2. Preconstruction meeting.
3. Regular job-site meetings.

E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.

1. As a minimum, provide:
   a. Separate area for storage of materials to be reused on-site, such as wood cut-offs for blocking.
   b. Separate dumpsters for each category of recyclable.
   c. Recycling bins at worker lunch area.
2. Provide containers as required.
3. Provide temporary enclosures around piles of separated materials to be recycled or salvaged.
4. Provide materials for barriers and enclosures that are nonhazardous, recyclable, or reusable to the maximum extent possible; reuse project construction waste materials if possible.
5. Locate enclosures out of the way of construction traffic.
6. Provide adequate space for pick-up and delivery and convenience to subcontractors.

7. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

SECTION 01 7610
TEMPORARY PROTECTIVE COVERINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary protective coverings for installed floors, walls, other surfaces and specialty items as determined by architect.

1.02 RELATED REQUIREMENTS

A. Section 01 7000 - Execution and Closeout Requirements: Coordination of requirements for materials specified in this section.

1.03 REFERENCE STANDARDS

A. ANSI A135.4 - American National Standard for Basic Hardboard 2012.

B. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board 2012.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2018b.

D. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.

E. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films 2015.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes available; and installation instructions.

C. Shop Drawings: Indicate existing finished surfaces to be protected.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Temporary Protective Coverings:

B. Substitutions: See Section 01 6000 - Product Requirements.

2.02 GENERAL

A. Provide materials that are easily removed without damage to the surfaces covered and with the following characteristics:

1. Water resistant.
2. Vapor permeable.
3. Impact resistant.
4. Slip resistant.
5. Flame retardant.

2.03 MATERIALS

A. Sheet Materials:

1. Corrugated polypropylene sheet.
2. Recycled paperboard/plastic composite sheet.
3. Recycled paperboard sheet.

4. Wood Hardboard: ANSI A135.4, tempered, 1/4 inch (6 mm) thick nominal.
5. Plywood, 1/2 inch (13 mm) thick nominal.
6. Fiberboard: ASTM C208, 1/2 inch (13 mm) thick nominal.
7. Water Vapor Permeability: Tested in accordance with ASTM E96/E96M.
8. Flame Retardance: Meet requirements of NFPA 701.
9. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.

B. Rolled Materials:

1. Self-adhering polyethylene film.
2. Recycled cellulose fiberboard paper.
3. Laminated glass fiber reinforced kraft paper.
4. Water Vapor Permeability: Tested in accordance with ASTM E96/E96M.
5. Flame Retardance: Meet requirements of NFPA 701.
6. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.

C. Corner and Door Jamb Protection Materials:

1. Cardboard, shaped specifically for application.
2. PVC plastic.

D. Tape: Type recommended by protective covering material manufacturer.

PART 3 EXECUTION

3.01 PREPARATION

A. Remove dirt and debris from surfaces to be protected.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Trim or overlap sheet materials to fit area to be covered.

C. Roll out and cut rolled materials to fit area to be covered.

D. Tape seams. Avoid taping directly to finished surfaces.

E. Stretch self-adhering film materials to completely cover surface.

F. Install door jamb protection to full height of opening.

3.03 REMOVAL

A. Remove protective coverings prior to Date of Substantial Completion. Reuse or recycle materials if possible.

3.04 PROTECTION ASSEMBLY SCHEDULE

END OF SECTION

SECTION 01 7800
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project Record Documents.

B. Operation and Maintenance Data.

C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. Section 00 7200 - General Conditions and 00 7300 - Supplementary Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.

B. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

C. Section 01 7000 - Execution and Closeout Requirements: Contract closeout procedures.

D. Individual Product Sections: Specific requirements for operation and maintenance data.

E. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.

B. Operation and Maintenance Data:

1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.

2. For equipment, or component parts of equipment put into service during construction and operated by Owner , submit completed documents within ten days after acceptance.

3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.

4. Submit two sets of revised final documents in final form within 10 days after final inspection.

C. Warranties and Bonds:

1. For equipment or component parts of equipment put into service during construction with Owner 's permission, submit documents within 10 days after acceptance.

2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.

3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:

1. Drawings.

2. Specifications.
3. Addenda.
4. Change Orders and other modifications to the Contract.
5. Reviewed shop drawings, product data, and samples.
6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner .

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:

1. Manufacturer's name and product model and number.
2. Product substitutions or alternates utilized.
3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:

1. Measured depths of foundations in relation to finish first floor datum.
2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
4. Field changes of dimension and detail.
5. Details not on original Contract drawings.

G. Owner shall be provided AutoDesk or BIM electronic files for records at conclusion of project.

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:

1. Product data, with catalog number, size, composition, and color and texture designations.
2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional information as specified in individual product specification sections.

E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:

1. Description of unit or system, and component parts.
2. Identify function, normal operating characteristics, and limiting conditions.
3. Include performance curves, with engineering data and tests.
4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

D. Include color coded wiring diagrams as installed.

E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

1. Include HVAC outdoor and exhaust air damper calibration strategy.
    a. Include provisions which ensure that full closure of dampers can be achieved.
2. Include Carbon Dioxide Monitoring Protocol.
3. Include Carbon Monoxide Monitoring Protocol.
4. Include Frost Mitigation Strategy for ventilation heat-recovery system.

G. Provide servicing and lubrication schedule, and list of lubricants required.

H. Include manufacturer's printed operation and maintenance instructions.

I. Include sequence of operation by controls manufacturer.

J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

K. Provide control diagrams by controls manufacturer as installed.

L. Provide Contractor 's coordination drawings, with color coded piping diagrams as installed.

M. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

N. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

O. Include test and balancing reports.

P. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate tabbed divider for each system.

C. Binders: Commercial quality, 8-1/2 by 11 inch (216 by 280 mm) three D side ring binders with durable plastic covers; 2 inch (50 mm) maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.

F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.

I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

J. Arrangement of Contents: Organize each volume in parts as follows:

1. Project Directory.
2. Table of Contents, of all volumes, and of this volume.
3. Operation and Maintenance Data: Arranged by system, then by product category.
    a. Source data.
    b. Product data, shop drawings, and other submittals.
    c. Operation and maintenance data.
    d. Field quality control data.
    e. Photocopies of warranties and bonds.
4. Design Data: To allow for addition of design data furnished by Architect or others, provide a tab labeled "Design Data" and provide a binder large enough to allow for insertion of at least 20 pages of typed text.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial

completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Manual: Bind in commercial quality 8-1/2 by 11 inch (216 by 279 mm) three D side ring binders with durable plastic covers.

F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.

G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION

SECTION 01 7900
DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.

B. Training of Owner personnel in operation and maintenance is required for:

1. All software-operated systems.
2. HVAC systems and equipment.
3. Plumbing equipment.
4. Electrical systems and equipment.
5. Items specified in individual product Sections.

C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:

1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
2. Finishes, including flooring, wall finishes, ceiling finishes.
3. Fixtures and fittings.
4. Items specified in individual product Sections.

1.02 RELATED REQUIREMENTS

A. Section 01 7800 - Closeout Submittals: Operation and maintenance manuals.

B. Section 01 9113 - General Commissioning Requirements: Additional requirements applicable to demonstration and training.

C. Other Specification Sections: Additional requirements for demonstration and training.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures; except:

1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority.
2. Submit one copy to the Commissioning Authority, not to be returned.
3. Make commissioning submittals on time schedule specified by Commissioning Authority.
4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word 2003 preferred.

B. Draft Training Plans: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.

1. Submit to Commissioning Authority for review and inclusion in overall training plan.
2. Submit not less than four weeks prior to start of training.
3. Revise and resubmit until acceptable.
4. Provide an overall schedule showing all training sessions.
5. Include at least the following for each training session:

a. Identification, date, time, and duration.

b. Description of products and/or systems to be covered.

c. Name of firm and person conducting training; include qualifications.

d. Intended audience, such as job description.

e. Objectives of training and suggested methods of ensuring adequate training.

f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.

g. Media to be used, such a slides, hand-outs, etc.

h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor .

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.

1. Include applicable portion of O&M manuals.

2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.

3. Provide one extra copy of each training manual to be included with operation and maintenance data.

D. Training Reports:

1. Identification of each training session, date, time, and duration.

2. Sign-in sheet showing names and job titles of attendees.

3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.

4. Include Commissioning Authority's formal acceptance of training session.

E. Video Recordings: Submit digital video recording of each demonstration and training session for Owner 's subsequent use.

1. Format: DVD Disc.

2. Label each disc and container with session identification and date.

1.04 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.

1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.

2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner .

B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.

C. Demonstration may be combined with Owner personnel training if applicable.

D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.

1. Perform demonstrations not less than two weeks prior to Substantial Completion.
2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.

1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Commissioning Authority will prepare the Training Plan based on draft plans submitted.

B. Conduct training on-site unless otherwise indicated.

C. Owner will provide classroom and seating at no cost to Contractor .

D. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.

E. Provide training in minimum two hour segments.

F. The Commissioning Authority is responsible for determining that the training was satisfactorily completed and will provide approval forms.

G. Training schedule will be subject to availability of Owner 's personnel to be trained; re-schedule training sessions as required by Owner ; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

H. Review of Facility Policy on Operation and Maintenance Data: During training discuss:

1. The location of the O&M manuals and procedures for use and preservation; backup copies.
2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
3. Typical uses of the O&M manuals.

I. Product- and System-Specific Training:

1. Review the applicable O&M manuals.
2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
4. Provide hands-on training on all operational modes possible and preventive maintenance.
5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
6. Discuss common troubleshooting problems and solutions.
7. Discuss any peculiarities of equipment installation or operation.

8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
9. Review recommended tools and spare parts inventory suggestions of manufacturers.
10. Review spare parts and tools required to be furnished by Contractor .
11. Review spare parts suppliers and sources and procurement procedures.

J. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION

SECTION 01 9113
GENERAL COMMISSIONING REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Commissioning is intended to achieve the following specific objectives; this section specifies the Contractor 's responsibilities for commissioning:

1. Verify that the work is installed in accordance with the Contract Documents and the manufacturer’s recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists executed by Contractor are utilized to achieve this.
2. Verify and document that functional performance is in accordance with the Contract Documents: Functional Tests executed by Contractor and witnessed by the Commissioning Authority are utilized to achieve this.
3. Verify that operation and maintenance manuals submitted to Owner are complete: Detailed operation and maintenance (O&M) data submittals by Contractor are utilized to achieve this.
4. Verify that the Owner ’s operating personnel are adequately trained: Formal training conducted by Contractor is utilized to achieve this.

B. Commissioning, including Functional Tests, O&M documentation review, and training, is to occur after startup and initial checkout and be completed before Functional Completion.

C. The Commissioning Authority directs and coordinates all commissioning activities; this section describes some but not all of the Commissioning Authority's responsibilities.

D. The Commissioning Authority is employed by Owner .

1.02 SCOPE OF COMMISSIONING

A. The following are to be commissioned:

B. Plumbing Systems:

C. HVAC System, including:

1. Major and minor equipment items.
2. Piping systems and equipment.
3. Ductwork and accessories.
4. Terminal units.
5. Control system.
6. Variable frequency drives.

D. Electrical Systems:

E. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

F. Indoor Air Quality Procedures: The Commissioning Authority will coordinate; Contractor will execute; see Section 01 5719 - Temporary Environmental Controls.

1.03 RELATED REQUIREMENTS

A. Section 01 3329 - Sustainable Design Reporting: Reporting requirements relating to commissioning.

B. Section 01 5719 - Temporary Environmental Controls: Precautions and procedures; smoking room testing; building flush-out.

C. Section 01 7000 - Execution and Closeout Requirements: General startup requirements.

D. Section 01 7800 - Closeout Submittals: Scope and procedures for operation and maintenance manuals and project record documents.

E. Section 01 7900 - Demonstration and Training: Scope and procedures for Owner personnel training.

F. Section 01 9114 - Commissioning Authority Responsibilities.

G. Section 23 0800 - Commissioning of HVAC: HVAC control system testing; other requirements.

1.04 REFERENCE STANDARDS

A. ANSI/RESNET/ICC 301 - Standard for the Calculation and Labeling of the Energy Performance of Low-Rise Residential Buildings using an Energy Rating Index 2014.

B. ANSI/RESNET/ICC 380 - Standard for Testing Airtightness of Building Enclosures, Airtightness of Heating and Cooling Air Distribution Systems, and Airflow of Mechanical Ventilation Systems 2016.

C. ASHRAE Std 202 - Commissioning Process for Buildings and Systems 2018.

D. ASTM E779 - Standard Test Method for Determining Air Leakage Rate by Fan Pressurization 2010 (Reapproved 2018).

E. CSI/CSC MF - Masterformat 2016.

F. NEBB S110 - Whole Building Technical Commissioning Of New Construction 2018.

G. PECI (Samples) - Sample Forms for Prefunctional Checklists and Functional Performance Tests Current Edition.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures; except:

1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority, unless they require review by Architect ; in that case, submit to Architect first.

2. Submit one copy to the Commissioning Authority, not to be returned.

3. Make commissioning submittals on time schedule specified by Commissioning Authority.

4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of Prefunctional Checklists or Functional Test requirements; submit in editable electronic format, Microsoft Word 2010 preferred.

5. As soon as possible after submittals made to Architect are approved, submit copy of approved submittal to the Commissioning Authority.

B. Product Data: If submittals to Architect do not include the following, submit copies as soon as possible:

1. Manufacturer's product data, cut sheets, and shop drawings.

2. Manufacturer's installation instructions.

3. Startup, operating, and troubleshooting procedures.

4. Fan and pump curves.

5. Factory test reports.

6. Warranty information, including details of Owner 's responsibilities in regard to keeping warranties in force.

C. Manufacturers' Instructions: Submit copies of all manufacturer-provided instructions that are shipped with the equipment as soon as the equipment is delivered.

D. Startup Plans and Reports.

E. Completed Prefunctional Checklists.

F. Commissioning Issues Log:

1. Construction observations.

2. Supporting photographs.

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required Functional Testing; unless otherwise noted such testing equipment will NOT become the property of Owner .

B. Calibration Tolerances: Provide testing equipment of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:

1. Temperature Sensors and Digital Thermometers: Certified calibration within past year to accuracy of 0.5 degree F (0.3 degree C) and resolution of plus/minus 0.1 degree F (0.05 degree C).

2. Pressure Sensors: Accuracy of plus/minus 2.0 percent of the value range being measured (not full range of meter), calibrated within the last year.

3. Calibration: According to the manufacturer’s recommended intervals and when dropped or damaged; affix calibration tags or keep certificates readily available for inspection.

C. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner ; such equipment, tools, and instruments are to become the property of Owner .

D. Dataloggers: Independent equipment and software for monitoring flows, currents, status, pressures, etc. of equipment.

1. Dataloggers required to for Functional Tests will be provided by the Commissioning Authority and will not become the property of Owner .

PART 3 EXECUTION

3.01 COMMISSIONING PLAN

A. Commissioning Authority has prepared the Commissioning Plan.

1. Attend meetings called by the Commissioning Authority for purposes of completing the commissioning plan.

2. Require attendance and participation of relevant subcontractors, installers, suppliers, and manufacturer representatives.

B. Contractor is responsible for compliance with the Commissioning Plan.

C. Commissioning Plan: The commissioning schedule, procedures, and coordination requirements for all parties in the commissioning process.

1. Commissioning will be phased (by floors, for example) to minimize the total construction time.

D. Basis of Design Documentation (BOD): Detailed documentation of the functional requirements of the project; descriptions of the systems, components, and methods chosen to meet the design intent; assumptions underlying the design intent.

1. Basis of Design Documentation is to be prepared by Architect .

E. Commissioning Schedule:

1. Submit anticipated dates of startup of each item of equipment and system to Commissioning Authority within 60 days after award of Contract.
2. Re-submit anticipated startup dates monthly, but not less than 4 weeks prior to startup.
3. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.
4. Provide sufficient notice to Commissioning Authority for delivery of relevant Checklists and Functional Test procedures, to avoid delay.

3.02 DOCUMENTATION IDENTIFICATION SYSTEM

A. Give each submitted form or report a unique identification; use the following scheme.

B. Type of Document: Use the following prefixes:

1. Startup Plan: SP-.
2. Startup Report: SR-.
3. Prefunctional Checklist: PC-.
4. Functional Test Procedure: FTP-.
5. Functional Test Report: FTR-.

C. System Type: Use the first 4 digits from CSI/CSC MF (Master Format), that are applicable to the system; for example:

1. 2300: HVAC system as a whole.
2. 2320: HVAC Piping and Pumps.
3. 2330: HVAC Air Distribution.

D. Component Number: Assign numbers sequentially, using 1, 2, or 3 digits as required to accommodate the number of units in the system.

E. Test, Revision, or Submittal Number: Number each successive iteration sequentially, starting with 1.

F. Example: PC-2320-001.2 would be the Prefunctional Checklist for equipment item 1 in the HVAC piping system, probably a pump; this is the second, revised submittal of this checklist.

3.03 STARTUP PLANS AND REPORTS

A. Startup Plans: For each item of equipment and system for which the manufacturer provides a startup plan, submit the plan not less than 8 weeks prior to startup.

B. Startup Reports: For each item of equipment and system for which the manufacturer provides a startup checklist (or startup plan or field checkout sheet), document compliance by submitting the completed

startup checklist prior to startup, signed and dated by responsible entity.

C. Submit directly to the Commissioning Authority.

3.04 PREFUNCTIONAL CHECKLISTS

A. A Prefunctional Checklist is required to be filled out for each item of equipment or other assembly specified to be commissioned.

1. No sampling of identical or near-identical items is allowed.
2. These checklists do not replace manufacturers' recommended startup checklists, regardless of apparent redundancy.
3. Prefunctional Checklist forms will not be complete until after award of the contract; the following types of information will be gathered via the completed Checklist forms:
    a. Certification by installing contractor that the unit is properly installed, started up, and operating and ready for Functional Testing.
    b. Confirmation of receipt of each shop drawing and commissioning submittal specified, itemized by unit.
    c. Manufacturer, model number, and relevant capacity information; list information "as specified," "as submitted," and "as installed."
    d. Serial number of installed unit.
    e. List of inspections to be conducted to document proper installation prior to startup and Functional Testing; these will be primarily static inspections and procedures; for equipment and systems may include normal manufacturer’s start-up checklist items and minor testing.
    f. Sensor and actuator calibration information.
4. All preliminary Prefunctional Checklists are included in the contract documents; the Commissioning Authority has the authority to modify these and will furnish final versions as applicable.
5. A preliminary list of Prefunctional Checklists is attached, to indicate anticipated scope.

B. Contractor is responsible for filling out Prefunctional Checklists, after completion of installation and before startup; witnessing by the Commissioning Authority is not required unless otherwise specified.

1. Each line item without deficiency is to be witnessed, initialed, and dated by the actual witness; checklists are not complete until all line items are initialed and dated complete without deficiencies.
2. Checklists with incomplete items may be submitted for approval provided the Contractor attests that incomplete items do not preclude the performance of safe and reliable Functional Testing; re-submission of the Checklist is required upon completion of remaining items.
3. Individual Checklists may contain line items that are the responsibility of more than one installer; Contractor shall assign responsibility to appropriate installers or subcontractors, with identification recorded on the form.
4. If any Checklist line item is not relevant, record reasons on the form.
5. Contractor may independently perform startup inspections and/or tests, at Contractor's option.
6. Regardless of these reporting requirements, Contractor is responsible for correct startup and operation.
7. Submit completed Checklists to Commissioning Authority within two days of completion.
8. See Section 01 7000 - Execution and Closeout Requirements for additional general startup requirements.

C. Commissioning Authority is responsible for furnishing the Prefunctional Checklists to Contractor .

1. Initial Drafts: Contractor is responsible for initial draft of Prefunctional Checklist where so indicated in the Contract Documents.
2. Provide all additional information requested by Commissioning Authority to aid in preparation of checklists, such as shop drawing submittals, manufacturers' startup checklists, and O&M data.
3. Commissioning Authority may add any relevant items deemed necessary regardless of whether they are explicitly mentioned in the Contract Documents or not.
4. When asked to review the proposed Checklists, do so in a timely manner.

D. Commissioning Authority Witnessing: Required for:

1. Each piece of primary equipment, unless sampling of multiple similar units is allowed by the commissioning plan.
2. A sampling of non-primary equipment, as allowed by the commissioning plan.

E. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner .

1. If difficulty in correction would delay progress, report deficiency to the Commissioning Authority immediately.

3.05 FUNCTIONAL TESTS

A. A Functional Test is required for each item of equipment, system, or other assembly specified to be commissioned, unless sampling of multiple identical or near-identical units is allowed by the final test procedures.

B. Contractor is responsible for execution of required Functional Tests, after completion of Prefunctional Checklist and before closeout.

C. Commissioning Authority is responsible for witnessing and reporting results of Functional Tests, including preparation and completion of forms for that purpose.

D. Contractor is responsible for correction of deficiencies and re-testing at no extra cost to Owner ; if a deficiency is not corrected and re-tested immediately, the Commissioning Authority will document the deficiency and the Contractor 's stated intentions regarding correction.

1. Deficiencies are any condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents or does not perform properly.
2. Use the standard form provided with copies submitted to Owner and Contractor .
3. When the deficiency has been corrected, the Contractor completes the form certifying that the item is ready to be re-tested and returns the form to the Commissioning Authority; the Commissioning Authority will reschedule the test and the Contractor shall re-test.
4. Identical or Near-Identical Items: If 10 percent, or three, whichever is greater, of identical or near-identical items fail to perform due to material or manufacturing defect, all items will be considered defective; provide a proposal for correction within 2 weeks after notification of defect, including provision for testing sample installations prior to replacement of all items.
5. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing.
6. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing if the test failed due to failure to execute the relevant Prefunctional Checklist correctly; if the test failed for reasons that would not have been identified in the Prefunctional Checklist process, Contractor shall bear the cost of the second and subsequent re-tests.

E. Functional Test Procedures:

1. Some test procedures are included in the Contract Documents; where Functional Test procedures are not included in the Contract Documents, test procedures will be determined by the Commissioning Authority with input by and coordination with Contractor .
2. Examples of Functional Testing:
    a. Test the dynamic function and operation of equipment and systems (rather than just components) using manual (direct observation) or monitoring methods under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint).
    b. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc.
    c. Systems are run through all the HVAC control system’s sequences of operation and components are verified to be responding as the sequence's state.
    d. Traditional air or water test and balancing (TAB) is not Functional Testing; spot checking of TAB by demonstration to the Commissioning Authority is Functional Testing.
3. Some preliminary Functional Test procedures are included in the contract documents; the Commissioning Authority has the authority to modify these and will furnish final versions as applicable.
4. A preliminary list of Functional Tests is attached, to indicate anticipated scope.

F. Deferred Functional Tests: Some tests may need to be performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions; performance of these tests remains the Contractor 's responsibility regardless of timing.

G. Factory Tests: Commissioning Authority and Contractor are responsible for coordinating testing of equipment at the factory by factory personnel, to ensure compliance with commissioning requirements.

H. Field Tests By Others: Where Functional Tests are indicated as to be performed by others not subject to the Contract Documents, those tests are not subject to these commissioning requirements.

3.06 SENSOR AND ACTUATOR CALIBRATION

A. Calibrate all field-installed temperature, relative humidity, carbon monoxide, carbon dioxide, and pressure sensors and gauges, and all actuators (dampers and valves) on this piece of equipment shall be calibrated. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.

B. Calibrate using the methods described below; alternate methods may be used, if approved by Commissioning Authority and Owner beforehand. See PART 2 for test instrument requirements. Record methods used on the relevant Prefunctional Checklist or other suitable forms, documenting initial, intermediate and final results.

C. All Sensors:

1. Verify that sensor location is appropriate and away from potential causes of erratic operation.
2. Verify that sensors with shielded cable are grounded only at one end.
3. For sensor pairs that are used to determine a temperature or pressure difference, for temperature make sure they are reading within 0.2 degree F (0.1 degree C) of each other, and for pressure, within tolerance equal to 2 percent of the reading, of each other.
4. Tolerances for critical applications may be tighter.

D. Sensors Without Transmitters - Standard Application:

1. Make a reading with a calibrated test instrument within 6 inches (150 mm) of the site sensor.
2. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.
3. If not, install offset, calibrate or replace sensor.

E. Sensors With Transmitters - Standard Application.

1. Disconnect sensor.
2. Connect a signal generator in place of sensor.
3. Connect ammeter in series between transmitter and building automation system control panel.
4. Using manufacturer’s resistance-temperature data, simulate minimum desired temperature.
5. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter.
6. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the building automation system.
7. Record all values and recalibrate controller as necessary to comply with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction.
8. Reconnect sensor.
9. Make a reading with a calibrated test instrument within 6 inches (150 mm) of the site sensor.
10. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.
11. If not, replace sensor and repeat.
12. For pressure sensors, perform a similar process with a suitable signal generator.

F. Sensor Tolerances for Standard Applications: Plus/minus the following maximums:

1. Watthour, Voltage, Amperage: 1 percent of design.
2. Pressure, Air, Water, Gas: 3 percent of design.
3. Air Temperatures (Outside Air, Space Air, Duct Air): 0.4 degrees F (0.2 degree C).
4. Relative Humidity: 4 percent of design.
5. Barometric Pressure: 0.1 inch of Hg (340 Pa).
6. Flow Rate, Air: 10 percent of design.
7. Flow Rate, Water: 4 percent of design.
8. AHU Wet Bulb and Dew Point: 2.0 degrees F (1.1 degrees C).
9. Hot Water Coil and Boiler Water Temperature: 1.5 degrees F (0.8 degrees C).
10. Cooling Coil, Chilled and Condenser Water Temperatures: 0.4 degrees F (0.2 degree C).
11. Combustion Flue Temperature: 5.0 degrees F (2.8 degrees C).
12. Oxygen and CO2 Monitors: 0.1 percentage points.
13. CO Monitor: 0.01 percentage points.
14. Natural Gas and Oil Flow Rate: 1 percent of design.

G. Critical Applications: For some applications more rigorous calibration techniques may be required for selected sensors. Describe any such methods used on an attached sheet.

H. Valve/Damper Stroke Setup and Check:

1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
2. Set pump/fan to normal operating mode.
3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
4. Command valve/damper to open; verify position is full open and adjust output signal as required.
5. Command valve/damper to a few intermediate positions.
6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

I. Isolation Valve or System Valve Leak Check: For valves not associated with coils.

1. With full pressure in the system, command valve closed.
2. Use an ultra-sonic flow meter to detect flow or leakage.

3.07 TEST PROCEDURES - GENERAL

A. Provide skilled technicians to execute starting of equipment and to execute the Functional Tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.

B. Provide all necessary materials and system modifications required to produce the flows, pressures, temperatures, and conditions necessary to execute the test according to the specified conditions. At completion of the test, return all affected equipment and systems to their pre-test condition.

C. Sampling: Where Functional Testing of fewer than the total number of multiple identical or near-identical items is explicitly permitted, perform sampling as follows:

1. Identical Units: Defined as units with same application and sequence of operation; only minor size or capacity difference.
2. Sampling is not allowed for:
    a. Major equipment.
    b. Life-safety-critical equipment.
    c. Prefunctional Checklist execution.
3. XX = the percent of the group of identical equipment to be included in each sample; defined for specific type of equipment.
4. YY = the percent of the sample that if failed will require another sample to be tested; defined for specific type of equipment.
5. Randomly test at least XX percent of each group of identical equipment, but not less than three units. This constitutes the "first sample."
6. If YY percent of the units in the first sample fail, test another XX percent of the remaining identical units.
7. If YY percent of the units in the second sample fail, test all remaining identical units.

8. If frequent failures occur, resulting in more troubleshooting than testing, the Commissioning Authority may stop the testing and require Contractor to perform and document a checkout of the remaining units prior to continuing testing.

D. Manual Testing: Use hand-held instruments, immediate control system readouts, or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the “observation”).

E. Simulating Conditions: Artificially create the necessary condition for the purpose of testing the response of a system; for example apply hot air to a space sensor using a hair dryer to see the response in a VAV box.

F. Simulating Signals: Disconnect the sensor and use a signal generator to send an amperage, resistance or pressure to the transducer and control system to simulate the sensor value.

G. Over-Writing Values: Change the sensor value known to the control system in the control system to see the response of the system; for example, change the outside air temperature value from 50 degrees F to 75 degrees F to verify economizer operation.

H. Indirect Indicators: Remote indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100 percent closed, are considered indirect indicators.

I. Monitoring: Record parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of the relevant control systems; where monitoring of specific points is called for in Functional Test Procedures:

1. All points that are monitored by the relevant control system shall be trended by Contractor ; at the Commissioning Authority’s request, Contractor shall trend up to 20 percent more points than specified at no extra charge.
2. Other points will be monitored by the Commissioning Authority using dataloggers.
3. At the option of the Commissioning Authority, some control system monitoring may be replaced with datalogger monitoring.
4. Provide hard copies of monitored data in columnar format with time down left column and at least 5 columns of point values on same page.
5. Graphical output is desirable and is required for all output if the system can produce it.
6. Monitoring may be used to augment manual testing.

3.08 OPERATION AND MAINTENANCE MANUALS

A. See Section 01 7800 - Closeout Submittals for additional requirements.

B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner .

C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

D. Commissioning Authority will add commissioning records to manuals after submission to Owner .

END OF SECTION

SECTION 01 9114
COMMISSIONING AUTHORITY RESPONSIBILITIES

PART 1 GENERAL

1.01 SUMMARY

A. Commissioning is intended to achieve the following specific objectives; this section covers the Commissioning Authority's responsibilities for commissioning:

1. Verify that the work is installed in accordance with the Contract Documents and the manufacturer’s recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists are utilized to achieve this.
2. Verify and document that functional performance is in accordance with the Contract Documents: Functional Tests performed by Contractor and witnessed by the Commissioning Authority are utilized to achieve this.
3. Verify that operation and maintenance manuals submitted to Owner are complete: Detailed O&M data submittals are specified.
4. Verify that the Owner ’s operating personnel are adequately trained: Formal training conducted by Contractor is specified.

B. Commissioning, including Functional Tests, O&M documentation review, and training, is to occur after startup and initial checkout and be completed before Substantial Completion.

C. Coordinate and direct all the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, frequently updated timelines and schedules and technical expertise.

1.02 SCOPE OF COMMISSIONING

A. The following are to be commissioned:

B. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

1.03 SUBMITTALS

A. Commissioning Plan:

1. Submit preliminary draft for review by Owner and Architect within 30 days after commencement of Commissioning Authority contract.
2. Submit revised draft to be included in the construction contract documents, not less than 4 weeks prior to bid date.
3. Submit final plan not more than 90 days after commencement of construction, for issuance to all parties.

B. Prefunctional Checklists:

1. Submit preliminary draft at start of construction documents phase or within 30 days after commencement of contract, whichever is later.
2. Submit revised draft for review by Owner and Architect not less than 6 weeks prior to bid date, for inclusion in the construction contract documents.
3. Submit final draft to Contractor not less than 4 weeks prior to startup of particular items to be commissioned.

C. Functional Test Procedures:

1. Submit preliminary draft at start of construction documents phase or within 30 days after commencement of contract, whichever is later.
2. Submit revised draft for review by Owner and Architect not less than 6 weeks prior to bid date, for inclusion in the construction contract documents.
3. Submit final draft to Contractor not less than 4 weeks prior to startup of particular items to be commissioned.

D. Training Plan.

E. Recommissioning Manual: Submit within 60 days after receipt of Owner's instructions to proceed with preparation.

F. Commissioning Record: Submit to Contractor for inclusion with O&M manuals.

G. Final Commissioning Report: Submit to Owner .

H. Sustainable Design Documentation: Submit Final Commissioning Report and Recommissioning Manual in accordance with requirements specified in Section 01 3329.02 - Sustainable Design Reporting - LEED v4.

PART 3 EXECUTION

2.01 COMMISSIONING PLAN

A. Prepare and maintain the Commissioning Plan, covering commissioning schedule, Prefunctional Checklist and Functional Test procedures, coordination requirements, and forms to be used, for all parties in the commissioning process.

1. Call and chair meetings of the Commissioning Team when appropriate.
2. Give Contractor sufficient notice for scheduling commissioning activities.
3. Develop a comprehensive start-up and initial systems checkout plan with cooperation of Contractor and subcontractors.
4. PECI (MCP) may be used as a guide for the Commissioning Plan.
5. ASHRAE Guideline 1.1 may be used as a guide for the Commissioning Plan.
6. Avoid replication of information included in the construction contract documents to the greatest extent possible.

B. Review the construction contract documents for Contractor submittals of draft checklists, draft test procedures, manufacturer startup procedures, and other information intended for the use of the Commissioning Authority in preparing the Commissioning Plan.

C. Commissioning Schedule:

1. Coordinate with Contractor anticipated dates of startup of each item of equipment and system.
2. Contractor 's scheduling responsibilities are specified in the construction contract documents.
3. Revise and re-issue schedule monthly.
4. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.
5. Deliver relevant Prefunctional Checklists and Functional Test Procedures to Contractor in time to avoid delay.

2.02 CONSTRUCTION CONTRACT DOCUMENTS

A. General Commissioning Specifications: Architect has prepared general commissioning specifications for inclusion in the construction contract documents; review and submit comments to Owner .

1. These specifications include:

a. Procedures applicable to all types of items to be commissioned.

2. Prepare specifications for any of the following that would be recommended, for incorporation into the construction contract documents by Architect :

a. Additional Contractor submittals needed for purposes of commissioning, such as startup procedures, draft test procedures, draft training plans, etc.

b. Additional Owner personnel training.

c. Additional operation or maintenance data that should be submitted.

B. Prefunctional Checklists: Develop detailed Checklists for each item to be commissioned.

1. List of Checklists to be Developed: Prepare and maintain a detailed list of titles, not full text.

2. The Checklist forms are intended to be part of the Contractor 's Contract Documents.

C. Functional Testing: Develop detailed procedures for each item to be commissioned; submit for review by Owner and Architect .

1. List of Test Procedures to be Developed: Prepare and maintain a detailed list of titles, not full text.

2. The forms the Commissioning Authority will use to report Functional Test results are not intended to be part of Contractor 's Contract Documents, but the Functional Test Procedures that must be executed by the Contractor must be made part of the Contract Documents, by modification if necessary.

D. Develop any other reporting forms Contractor will be required to use; if they are likely to require a substantially different amount of work than the Contractor can reasonably anticipate, they must be included in the construction contract documents.

E. If any part of the documents described above have not been developed by the bid date, coordinate with Architect the issuance of modifications to the construction contract documents

2.03 PREFUNCTIONAL CHECKLISTS

A. Prefunctional Checklists - Content: Prepare forms for Contractor 's use, in sufficient detail to document that the work has been installed in accordance with the Contract Documents and the manufacturer’s recommendations and instructions, and that it receives adequate operational checkout prior to startup.

1. Prepare separate Checklists for each type of equipment, system, or other assembly, customized to the item.

2. Identify each Checklist by using the contract documents identification number or name, if any; if none, create unique identifiers for each Checklist; do not rely on Contractor to number checklists.

3. Multiple identical or near-identical items may appear on a single Checklist provided there is space to record all required data for each separately; label each set of data uniquely.

4. Include space to record manufacturer name, model number, serial number, capacity and other relevant characteristics, and accessories and other features as applicable; include space to record "as specified", "as submitted", and "as installed" data.

5. Include space to record whether or not the required submittals have been received; list each separate type of submittal.

6. Include line items for each physical inspection to be performed.

7. Include line items for each operational inspection to be performed, such as checking switch operation, fan rotation, valve and damper stroke, and measuring actual electrical loads.
8. Include separate section for sensors and actuators, with space for documenting actual physical location and calibration measurements; provide a separate generic calibration checklist identified wherever referenced.
9. Include spaces to record that related Checklists for related work upon which this work depends have been completed.

B. Prefunctional Checklists - Format:

1. Provide a cover sheet showing name of equipment item or system, documentation identification number (see Documentation Identification Scheme), names of accessory components involved, and identification of related checklists.
2. Include on cover sheet space for Contractor 's use in attesting to completeness; provide spaces for the signatures of the general contractor and each subcontractor or other entity responsible, customized to the project and the type of item.
3. Include on the cover sheet, above the signature block, the following statement: "The work referenced in this Checklist and other work integral to or dependent on this work is complete and ready for functional testing. The checklist items are complete and have been checked off only by parties having direct knowledge of the event." Include two checkboxes:
    a. "This Checklist is submitted for approval with no exceptions."
    b. "This Checklist is submitted for approval, subject to the attached list of outstanding items, none of which preclude the performance of safe and reliable functional tests. A statement of completion will be submitted upon completion of the outstanding items."
4. Use a consistent, tabular format for all Checklists, with one line per checklist activity.
5. For each line item, provide space for initials and date, and identification of the subcontractor or other entity responsible.

2.04 FUNCTIONAL TEST PROCEDURES

A. Develop test procedures in sufficient detail to show that functional performance is in accordance with the Contract Documents and shows proper operation through all modes of operation where there is a different system response, including seasonal, unoccupied, warm-up, cool-down, part- and full-load.

1. Obtain assistance and review by installing subcontractors.
2. Itemize each test sequence in step-by-step order, with acceptance criteria for each step and for the test as a whole.
3. Include test setup instructions, description of tools and apparatus, special cautions, and.
4. Avoid procedures that would void or otherwise limit warranties; review with Contractor prior to execution.
5. For HVAC systems, procedures may include energy management control system trending, stand-alone datalogger monitoring or manual functional testing.
6. Obtain explicit approval of Contractor in regard to feasibility and safety prior to execution.

B. Functional Test Report Forms: Prepare forms in advance of testing, using a consistent format; include all test procedure information given to Contractor and:

1. Report Identifier (see Documentation Identification Scheme).
2. Test prerequisites.

3. Formulas to be used in calculations.
4. Yes/No check boxes for each step of test.
5. Space to record results, document deficiencies, and make recommendations.
6. Signature and date block for Commissioning Authority.

C. Functional Test Prerequisites: Include space to verify all of the following items on each Functional Test Report Form, unless truly inapplicable:

1. All related equipment has been started up and start-up reports and Prefunctional Checklists submitted and approved ready for Functional Testing.
    a. For hydronic systems, check that:
        1) Piping system flushing is complete and required report approved.
        2) Water treatment system is complete and operational.
        3) Test and balance (TAB) is complete and approved.
2. All control system functions for this and all interlocking systems are programmed and operable in accordance with the Contract Documents, including final set points and schedules with debugging, loop tuning and sensor calibrations completed, with space for signature of controls installer.
3. Incomplete items identified by Architect during closeout inspections have been corrected or completed.
4. Safeties and operating ranges have been reviewed.
5. A copy of the specified sequence of operation is attached.
6. A copy of applicable schedules and setpoints is attached.
7. A copy of the specified Functional Test Procedures is attached.
8. The Functional Test Procedures have been reviewed and approved by the applicable installer.
9. Vibration control report approved (if required).
10. False loading equipment, system and procedures ready.
11. Sufficient clearance around equipment for servicing.
12. Original values of pre-test setpoints that need to be changed to accommodate testing have been recorded, with a check box provided to verify return to original values (include control parameters, limits, delays, lockouts, schedules, etc.).
13. Any other items on the Prefunctional Checklist or Start-up Reports that need to be re-verified.

2.05 CONSTRUCTION PHASE

A. Coordinate the commissioning work with Contractor and Construction Manager; ensure that commissioning activities are being incorporated into the master schedule.

B. Perform site visits, as necessary, to observe component and system installations. Attend planning and job-site meetings to obtain information on construction progress. Review Contractor 's meeting minutes for issues relating to the commissioning process. Assist in resolving discrepancies.

C. Commissioning Kick-Off Meeting: Plan and conduct a meeting early in the construction phase to review commissioning activities and responsibilities with all parties involved. Require attendance by all members of the Commissioning Team.

D. Conduct periodic meetings as necessary to coordinate, resolve planning issues, and aid in resolution of deficiencies, minimizing the time spent by Contractor and Owner personnel; hold meetings at least

monthly.

E. Submit periodic progress reports to Owner and Contractor .

F. Review Contractor shop drawing submittals applicable to systems being commissioned for compliance with commissioning needs; verify that Owner 's responsibilities are clearly defined in warranties.

G. Review and approve submittals directly related to commissioning.

H. Deliver Prefunctional Checklists and Functional Test procedures to Contractor .

I. Verify satisfactory completion of Prefunctional Checklists by Contractor by reviewing checklists and by site observation and spot checking; provide formal approval when satisfactory.

J. Verify startup of all systems by reviewing start-up reports and by site observation; provide formal approval when satisfactory.

K. Coordinate, witness and approve Functional Tests performed by Contractor . Coordinate retesting until satisfactory performance is achieved.

L. HVAC Commissioning:

1. Gather and review the control sequences and interlocks and work with Contractor and design engineers until sufficient clarity has been obtained, in writing, to be able to prepare detailed Functional Test procedures.
2. Witness all or part of HVAC piping test and flushing procedures, sufficient to be confident that proper procedures were followed; document testing and include documentation in O&M manuals.
3. Witness all or part of duct testing and cleaning procedures, sufficient to be confident that proper procedures were followed; document testing and include documentation in O&M manuals.
4. Review TAB Plan prepared by Contractor .
5. Before TAB is executed, witness sufficient Functional Testing of the control system to approve it to be used for TAB.
6. Verify air and water systems balancing by spot testing, by reviewing completed reports, and by site observation; provide formal approval when satisfactory.
7. Analyze trend logs and monitoring data to verify performance.

M. Witness and document testing of systems and components over which the Commissioning Authority does not have direct control, such as smoke control systems, tests contracted directly by Owner , and tests by manufacturer’s personnel; include documentation in O&M manuals.

N. When Functional Testing for specific systems or equipment is specified to be performed by the Commissioning Authority rather than the Contractor, perform such testing without assistance of Contractor.

O. Maintain a master deficiency and resolution log and a separate testing record. Provide written progress and test reports with recommended actions.

P. O&M Data: Review submitted operation and maintenance data for completeness; provide formal approval if satisfactory.

Q. Notify Contractor and Owner of deficiencies in procedures or results; suggest solutions.

2.06 TRAINING

A. Training Plan: Prepare a comprehensive Training Plan, incorporating draft training plans submitted by Contractor .

1. Include a 8 hour session by the HVAC design engineer covering the overall HVAC system and equipment design concepts, with one-line schematic drawings.
2. Include a 8 hour session by the Commissioning Authority on the use of the blank Prefunctional Checklists and Functional Test report forms for re-commissioning purposes.
3. Establish criteria for determining satisfactory completion of training.

B. Verify that training was satisfactorily completed; provide formal approval if satisfactory.

2.07 CLOSEOUT

A. Commissioning Record: Use the same format and organization as specified for the O&M manuals.
1. Include the Final Commissioning Plan and Final Report.
2. For each product or system and equipment item, include the following organized as indicated, with separator tabs:
a. Design intent documentation, furnished by Architect or others.
b. Detailed operational sequences.
c. Startup plan and approved startup reports.
d. Filled out Prefunctional Checklists.
e. Filled out Functional Test reports; trend logs and monitoring reports and analysis; other verification documentation.
f. Training plan and training records.
g. Recommissioning recommendations, including time schedule and procedures; include blank copies of all Prefunctional Checklists and Functional Test report forms.

B. Final Commissioning Report: Include:
1. Executive summary.
2. List of participants and roles.
3. Brief facility description.
4. Overview of commissioning scope and general description of testing and verification methods.
5. For each item commissioned, an evaluation of adequacy of:
a. The product itself; i.e. compliance with the contract documents.
b. Installation.
c. Functional performance; include a brief description of the verification method used and observations and conclusions from the testing.
d. O&M documentation, including design intent.
e. Operator training.
6. List of all outstanding non-compliance items, referenced to the specific functional test, inspection, trend log, etc., where the deficiency is documented.
7. List of unresolved issues, seasonal or deferred testing, and other concerns that could affect facility operation.
8. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc. (about four to six pages).

9. Attach appendices containing all commissioning documentation, including logs, minutes, reports, deficiency lists, communications, findings, etc., except that specified to be part of the Commissioning Record.

C. Recommissioning Manual: Revise the Commissioning Plan documents, checklists, and Functional Test forms as necessary based on accepted recommendations of the final Commissioning Report. Provide step-by-step instructions for recommissioning, blank forms, and cross-references to O&M data needed during recommissioning.

2.08 POST-OCCUPANCY PHASE

A. Coordinate deferred and seasonal Functional Tests; verify correction of deficiencies.

B. On-Site Review: 10 months after Substantial Completion conduct on-site review with Owner 's staff.

1. Review the current facility operation and condition of outstanding issues related to the original and seasonal commissioning.
2. Interview staff to identify problems or concerns they have operating the facility as originally intended.
3. Make suggestions for improvements and for recording these changes in the O&M manuals.
4. Identify areas of concern that are still under warranty or are the responsibility of the original construction contractor.
5. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.

END OF SECTION

SECTION 02080 – ASBESTOS REMOVAL

I SCOPE OF WORK: Asbestos Abatement

Base Bid: The Base Bid shall include the total cost of all asbestos abatement work described. This work shall be performed in accordance with this Section, the plans, all other bid documents, and all federal and state regulations.

A. PGCPS requires all Asbestos Abatement to be performed by a PGCPS Approved Vendor. Please see the attached list for all PGCPS Approved vendors.
B. The contractor will provide all labor, materials, equipment, supervision, testing, permits and all other incidentals required to remove the asbestos containing materials (ACM) listed within these specifications from the areas indicated on the drawings and as described as follows:

1. The contractor shall, completely remove all asbestos containing mastic/caulking associated with wallboards, cement sinks, pipe insulation, duct insulation, floor tile, windows, and mastic in the areas indicted in the drawings.
2. Completely remove all asbestos containing acoustical ceiling tile. Contractor will replace all abated acoustical ceiling tile.
3. Remove all other ACM material encountered and or exposed during project work or involving connection to existing concealed building utilities.
4. The contractor shall, completely remove all asbest

C. The Abatement Contractor shall provide the complete isolation of the work area(s) as needed, and for the total cleaning and decontamination of the area(s) such that no airborne or residual asbestos remains in accordance with the applicable regulatory provisions. The contractor shall be responsible for the proper removal, storage, transportation and disposal of asbestos waste. No waste or debris will be placed in any BOARD owned dumpster or refuse container.

D. The Abatement Contractor can use existing electrical receptacles to operate their equipment. Any electrical work required by the contractor (moving light fixtures, installing "pigtails" for equipment, etc.) must be completed by a contractor, licensed to perform electrical work in Prince Geo**r**ges County, Maryland. Prices for performing such work shall be incorporated in the total job cost submitted.

E. The BOARD will contract a BOARD approved independent air monitoring company to conduct daily air sampling, final visual inspection and subsequent clearance air and bulk sampling as described in Article X of this document.

F. The contractor will retain primary responsibility for all means, methods, sequencing and coordination during the asbestos abatement phase. Responsibility for the preparation, accuracy, and execution of any drawings or work plans remains with the Contractor. The contractor shall communicate with the general contractor in order to secure access to power, water, telephone and other utilities as part of his bid.

G. This document addresses only the ACM that is associated with the actual work areas. This serves as notice that some materials in other areas within the facility, also has been identified as ACM. It is the General Contractor's responsibility to review the Asbestos Management Plan for each School and familiarize his employees, inclusive of all Subcontractors, that ACM is present and the possible locations that it may be encountered. Any and all work that involves handling of ACM must be conducted by the asbestos contractor, approved by the BOARD.

H. The cost of any planned or un-planned clean-up activity, inclusive of all school system personnel salaries, required relative to ACM being disturbed by abatement, demolition or construction activities, shall be borne by the Asbestos Contractor.

II REGULATIONS:

A. All work must comply with all applicable Federal, State and County regulations. Work performed in this building falls within the regulatory authority of the Asbestos Hazard Emergency Response Act (AHERA). All workers and supervisors are required to be AHERA certified.

B. All employees performing work on this project must be accredited as required by the Federal AHERA regulations and certified to remove asbestos under the Maryland COMAR Regulations. Appropriate AHERA accreditation must be held by all workers, supervisors and project designers.

C. The successful bidder shall ensure that an Abatement Supervisor (as described in the AHERA Regulations) is on-site at all times during any asbestos removal activity that is conducted during this project. The Supervisor shall be able to present accreditation documents for all workers.

D. All work must comply with the following Federal and State regulations which govern asbestos abatement work or hauling and disposal of asbestos waste materials including but not limited to the following:

1. U. S. Environmental Protection Agency (EPA) including but not limited to:
   - Asbestos Abatement Projects Rule
     CFR Part 762
     TS 62044, FRL 2843-9
     Federal Register, Vol 50 No 134, July 12,1985
     8530-28540
   - Regulation for Asbestos
     Title 40, Part 61, Subpart A of the
     Code of Federal Regulations
   - National Emission Standard for Asbestos
     Title 40, Part 61, Subpart M (Revised Subpart B)
     of the Code of Federal Regulations

2. U.S. Department of Labor, Occupational Safety and Health Administration, (OSHA), including but not limited to:
   - Occupational Exposure to Asbestos, Tremolite,
     Anthophyllite, and Actinolite; Final Rules
     Title 29, Part 1910, Section 1001 and
     Part 1926, Section 1101 of the Code of Federal Regulations
   - Respiratory Protection
     Title 29, Part 1910, Section 134 of the Code of Federal Regulations
   - Construction Industry Asbestos Standard
     Title 29, Part 1926, of the Code of Federal Regulations
     Construction Industry Lead Standard
     Title 29, Part 1926, Section 62, of the Code of Federal Regulations
   - Access to Employee Exposure and Medical Records
     Title 29, Part 1910, Section 2 of the Code of Federal Regulations
   - Hazard Communication
     Title 29, Part 1910, Section 1200 of the Code of Federal Regulations
   - Specifications for Accident Prevention Signs and Tags
     Title 29, Part 1910, Section 145 of the Code of Federal Regulations
3. State of Maryland
   - Control of Asbestos Act, Maryland Code, COMAR Title 26
     Subtitle 11, Chapter 21

- Asbestos Accreditation of Individuals, and Approval of Training Courses, Maryland Code, COMAR Title 26, Subtitle 11, Chapter 23

III SITE VISIT:

A. Bidders should visit the site to verify existing conditions and establish the amount of ACM to be removed. Arrangements for a site visit must be made through the BOARD'S Environmental Office at (301) 952-6539**. NO UNAUTHORIZED VISITS WILL BE PERMITTED**.

B. A schematic representation, which indicates the actual work areas, is included for informational purposes, only. The materials listed in the "Scope of Work" portion of this document, are to be removed completely, unless otherwise documented in writing by the BOARD. The BOARD will not accept sample analysis that the contractor submits relevant to a specific material that is not ACM.

IV SUBCONTRACTORS:

A. Full documentation of the firm that will conduct the asbestos work, including certifications and a signed statement affirming they visited the building, must be approved within two(2) business days after the apparent low bidder is notified. This shall include copies of their Maryland License accreditation(s), and references from at least five previous jobs. No contractor substitutions will be permitted, without the BOARD'S consent, after the BOARD reviews and verifies the provided information.

B. The BOARD can reject an Asbestos contractor, if they have demonstrated poor or unsafe performance or poor quality of work from past projects. Any additional costs incurred by the subcontractor or a general contractor, as a result of this action being taken, will not be the responsibility of the BOARD. Asbestos contractors must be pre-approve, with the BOARD's Environmental Office, at least one week prior to the bid due date for this project.

C. In a case where an asbestos contractor has violated any terms or condition of his contract, the BOARD reserves the right to obtain another reputable abatement contractor to complete the remaining work. All associated costs relative to that work shall be borne by the original abatement contractor.

V ASBESTOS REMOVAL PLANS:

A. As soon as possible but not later than 14 calendar days after receipt of a contract award, the successful bidder shall submit a detailed removal plan, for each facility, including shop drawings, prepared and signed by an accredited AHERA Project Designer, for the Board's approval. The drawings shall detail the following items for each work section, as required:

1. Work areas
2. Work entrance and exit points
3. Shower and clean room locations
4. Locations and quantities of negative pressure ventilation equipment
5. Storage locations for supplies and equipment
6. Storage locations for removed materials prior to such materials being transported off site
7. Cleanup and waste disposal plans
8. The locations of any demolition activity the contractor may undertake in order to gain access to remove any ACM
9. Work schedule
10. Number of workers and copies of their qualifications

VI NOTIFICATION TO REGULATORY AUTHORITIES:

The contractor is responsible for making required notification to the Maryland Air Management Administration, the Environmental Protection Agency and any other regulatory authorities with jurisdiction. Copies of such notification must be provided to the BOARD before work can begin.

A. NOTICES: ENVIRONMENTAL PROTECTION AGENCY

Send Written Notification as required by USEPA National Emission Standards for Hazardous Air Pollutants (NESHAPS) Asbestos Regulations (40CFR 61, Subpart M) to the regional Asbestos NESHAPS Contact at least 10 days prior to beginning any work on asbestos-containing materials. Send notification to the following address:

REGION 3:
USEPA, Region III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

1. Notification must be sent to EPA for all demolitions and for renovations involving 160 square feet or 260 linear feet or more.

2. Notification: Include the following information in the notification sent to the NESHAPS Contact:
   - Name and address of owner or operator.
   - Description of the facility being demolished or renovated, including the size, age, and prior use of the facility.
   - Estimate of the approximate amount of friable asbestos material present in the facility in terms of linear feet of pipe, and surface area on other facility components. For facilities in which the amount of friable asbestos materials less than 80 linear meters (260 linear feet) on pipes and less than 15 square meters (160 square feet) on other facility components, explain techniques of estimation.
   - Location of the facility being demolished or renovated.
   - Scheduled starting and completion dates of demolition or renovation.
   - Nature of planned demolition or renovation and method(s) to be used.
   - Procedures to be used to comply with the requirements of USEPA National Emission Standards for Hazardous Air Pollutants (NESHAPS) Asbestos Regulations (40 CFR 61 Subpart M). Final Rule.
   - Name and location of the waste disposal site where the friable asbestos waste material will be deposited.
   - For facilities being demolished under an order of a State or local governmental agency, issued because the facility is structurally unsound and in danger of imminent collapse, the name, title, and authority of the State or local governmental representative who has ordered the demolition.

B. STATE AGENCIES:

Send written Notification as required by local regulations prior to beginning any work on asbestos-containing materials to:

Asbestos Licensing/Enforcement Division
MD Department of Environment (MDE)
1800 Washington Boulevard
Baltimore, Maryland 21230

1. Notification must be postmarked 10 working days prior to commencement of work.)

C. LICENSES:

1. Licenses: Maintain current licenses as required by applicable state or local jurisdictions for the removal, transporting, disposal or other regulated activity relative to the work of this contract.
2. Posting and Filing of Regulations: Maintain two (2) copies of applicable federal, state and local regulations above. Post one copy of each at the job site. Keep on file in contractor's office one copy of each.

Copies of all notification will be provided to the BOARD before work can begin.

VII ALTERNATIVE PROCEDURES:

A. Procedures described in the specifications will be used at all times. If the specified procedures cannot be utilized, the contractor shall provide a written statement to the BOARD'S Environmental Office describing the problems encountered and recommended alternatives. Any alternative procedures must be approved by the BOARD and regulatory authorities before implementation. The BOARD reserves the right to reject any variances or alternative methods not found to be acceptable to the BOARD.

B.

VIII MONITORING WORK PROGRESS:

A. The BOARD's Environmental Office, Safety Office and/or contracted industrial hygienist will monitor the progress of work. This person(s) shall have the authority to make work-in progress inspections at any time and to stop work if, in their opinion, an immediate health threat exists to the public or the contractor's employees due to improper work methods or noncompliance with the specifications or regulations.

B. In situations where job site performance is unsatisfactory but does not present an immediate health threat to the public or workers, a written warning will be given to the contractor. A deadline will be given to correct the referenced situation. Failure to comply with said written orders could be considered grounds for shutting down a job until said condition has been remedied to the satisfaction of the BOARD.

C. The BOARD'S Environmental Office and/or the contracted industrial hygiene consultant will have final authority over questions of interpretation of regulations and specifications. Whenever a conflict occurs, the most stringent requirement shall be followed.

IX PERMISSION TO BEGIN WORK:

A. Prior to asbestos abatement activities (including preparatory work such as containment system fabrication), a pre-job meeting shall be scheduled at which time the contractor shall submit proof satisfactory to the BOARD that all required permits and arrangements for transportation and disposal of waste materials have been made. The Contractor shall also provide a list of all employees who will be working on the project along with submitting AHERA. and Maryland training accreditation for these workers. At the pre-job meeting, the Contractor and the BOARD'S Environmental Office representative will review the specifications and asbestos removal plans. The BOARD'S Environmental Office will respond verbally to any questions by the Contractor. The BOARD will document all verbal authorization via written memoranda.

B. The contractor shall not begin any site work, either actual abatement or preparatory work until he has received verbal permission from the Environmental Office. The BOARD will document all verbal authorizations via written memoranda.

C. After completing preparatory activities for each work area, the contractor must arrange for a site inspection by the BOARD's Environmental Office before authorization to begin actual asbestos removal. During this inspection the contractor shall demonstrate (where applicable) that the containment system, mini enclosures, work entrance way, etc. are properly sealed and all meet the specifications. Additionally, he will be required to prove proper operation of any required negative pressure ventilation equipment. This inspection process shall be repeated as each new work area is established. No asbestos removal can begin until the satisfactory completion of such an inspection.

X. AIR SAMPLING BY THE CONTRACTOR AND/OR CONTRACTED INDUSTRIAL HYGIENE CONSULTANT:

A. **PERSONAL SAMPLING -** The contractor will be responsible for conducting and paying for "personal" air samples during the course of work. Personal air monitoring will be conducted for the maintenance of Time Weighted Average (TWA) fiber counts for types of respiratory protection required. This includes

Short Term Excursion (STEL) Level samples of 30 minutes. These samples can be collected by the contracted industrial hygiene consultant.

B. **BACKGROUND SAMPLING** - The BOARD's hygiene consultant will conduct background air samples for each containment area to establish background fiber levels prior to work commencing along with all daily air tests and personal air sampling. These samples can be collected by the contracted industrial hygiene consultant. The hygiene consultant shall coordinate with the BOARD'S Environmental Office the exact location where these samples will be taken and the time of day when daily samples will be taken. The analysis laboratory shall use methods approved by the Environmental Protection Agency. The samples will be archived in case the BOARD has a need to retrieve them.

C. Results of the air test taken within the work area prior to commencement of work will determine the need for respirator use during construction of containment systems. If these air tests show fiber levels higher than the permissible exposure limit, respirators will be worn during containment fabrication; otherwise respirator use during this phase is optional. "Personal" samples will be taken during containment construction since airborne fiber levels may increase during this work. If the results of the samples taken during this activity show levels higher than the permissible exposure limit, respirators and other protective equipment shall immediately be utilized for the remainder of all containment work.

D. **OUTSIDE AMBIENT AIR SAMPLES**

1. Air Samples will be collected daily outside but nearby the work area to detect faults in the work area isolation such as:
   - Contamination of the building outside of the work area with airborne asbestos fibers,
   - Failure of filtration or rupture in the negative pressure system,
   - Contamination of the building exterior with airborne asbestos fibers
2. These samples will be collected by the contracted industrial hygiene consultant. If airborne fiber levels in such samples exceed air fiber levels revealed in the "before work" (background) ambient samples or 0.1 fibers per cubic centimeter (fiber/cc), the contractor shall immediately stop work and notify the BOARD's Environmental Office. If this air sample was taken inside the building and outside of critical barriers around the work area, the contractor shall immediately inspect the critical barriers to ensure their integrity. The affected area shall be isolated from the balance of the building and evacuated if the area is occupied. Critical barriers shall be erected at the next existing structural isolation of the involved space (e.g.

wall, pipe, and floor). The project will be reviewed jointly by the contractor and the BOARD's Environmental Office to determine and correct the cause of the high air sample results. The contractor will clean the outside area and retest before work can be restarted.

E. **INSIDE AIR SAMPLES**

The contractor shall maintain an average airborne count in the work area of less than 0.2 fibers/cc. If the fiber counts rise above this figure for any sample taken, the contractor shall revise work procedures (i.e., additional use of amended water or increased negative pressure to lower fiber counts). If these methods do not effectively reduce the average airborne level then the contractor is to stop all work, leave engineering controls/negative air system in operation and notify the BOARD'S Environmental Office. Do not recommence work until authorized by the BOARD'S Environmental Office.

F. **ANALYTICAL METHODS:**

The NIOSH 7400 method of phase contrast microscopy will be used by the laboratory in analyzing filters used to collect air samples before and during abatement. Transmission Electron Microscopy shall be performed on final air sampling.

G. **SAMPLE VOLUMES:**

General: The number and volume of air samples taken by the Industrial Hygiene Consultant will be in accordance with the following schedule. Sample volumes given may vary depending upon the analytical method used.

H. **SCHEDULE OF AIR SAMPLES**: Before Start of Work: **Base Line**: Pre-Tests are taken to establish background levels of airborne fibers to determine respiratory protection required during preparation of the work area. If any of the Pre-Tests or the air samples taken during preparation are $\geq$0.01 fibers per cubic centimeter (f/cc) the workers shall wear respiratory protection. The type of respirator worn shall be determined by the standards set in OSHA Regulations 29CFR 1910.1001. The Industrial Hygiene Consultant will secure the following Air Samples:

SCHEDULE BASE LINE : Before Start of Work (Pre-Test).

Project Size	IWA	OWA	Blank	Analysis
≥5,000 SF	**5**	**5**	**2**	**PCM**
≥500 LF	**5**	**5**	**2**	**PCM**
≤5,000 SF	**5**	**5**	**2**	**PCM**
≤ 500 LF	**5**	**5**	**2**	**PCM**

ACM - Asbestos Containing Material **TEM** - Transmission Electron Microscopy
IWA - Inside Work Area
OWA - Outside Work Area
PCM - Phase Contrast Microscopy, NIOSH 7400 Method

SCHEDULE OF DAILY AIR SAMPLES : During Work

Project Size	IWA	OWA	Blank	Analysis
≥5,000 SF	**4**	**4**	**2**	**PCM**
≥500 LF	**4**	**4**	**2**	**PCM**
≤5,000 SF	**2**	**2**	**2**	**PCM**
≤ 500 LF	**2**	**2**	**2**	**PCM**

ACM - Asbestos Containing Material
IWA - Inside Work Area
OWA - Outside Work Area
PCM - Phase Contrast Microscopy, NIOSH 7400 Method
TEM - Transmission Electron Microscopy

XI **LABORATORY TESTING:**

A. The services of a testing laboratory will be employed by the Industrial Hygiene Consultant to perform laboratory analysis of the air samples. A microscope and technician will be setup at the job site (where project conditions permit), so that verbal reports on air samples can be obtained immediately.

B. The services of a testing laboratory will be employed by the Contractor to perform laboratory analysis of the OSHA air samples.

C. A complete record, certified by the testing laboratory, of all air monitoring tests and results will be furnished to the BOARD'S Environmental Office.

D. Verbal Reports: of all air monitoring tests will be communicated at the job site by the Industrial Hygiene Consultant, to the Contractor on a daily basis. Air sample results shall be posted in a central location on a daily basis.

E. Exposure monitoring of the work place for employees safety will be performed in accordance with Occupational Safety and Health Administration (OSHA) Asbestos Regulations for the Construction Industry (20 CFR 1926.1101).

F. Verbal results for all air samples shall be supplied to the BOARD within 24 hours, with written results maintained at the work site.

XII. DAMAGE TO THE BUILDING:

A. Care shall be taken by the contractor not to damage finishes, wiring, piping or other building systems or equipment. Any such damage shall be corrected per all relative codes and regulations at the contractor's expense.

XIII. ASBESTOS WORKER ACCESS:

A. All work entry is to be made through the nearest exterior door. This location will be given to the Contractor at the pre-construction meeting.

B. Limited parking is available in the school's parking lot. Vehicles must be parked in parking spaces. No parking will be permitted in fire lanes, loading zones, reserved parking spaces, grass, etc. A clear lane must be kept at all times for emergency vehicles, deliveries, and other school traffic.

C. The Contractor shall supply protective equipment, including a respirator and disposable suit to the school Custodian in the event he needs to enter the work area during asbestos removal.
D. Smoking is not permitted in this facility or on the property.

XIV. ASBESTOS WORK SCHEDULE:

A. Preliminary asbestos removal work cannot begin until the BOARD issues a written notice to the General Contractor. All asbestos abatement activities, relevant to the ACM found in the actual work area, must be completed within Fourteen (14) calendar days.

B. The Contractor is responsible for paying the wages of the school system personnel if the work is conducted during times when the facility is not staffed.

C. The general Contractor shall limit any other work activities that may inhibit the progress of the asbestos removal work.

D. The BOARD reserves the right to require that all activities involving asbestos work, be conducted during the hours when the school is normally occupied. The BOARD will pay no additional cost, if this stipulation is invoked.

XV. DISPOSAL OF ASBESTOS:

A. The contractor is free to utilize any landfill approved to accept friable asbestos waste. The contractor shall submit with their bid response, the name and address of the facility he proposes to use.
B. Transportation of asbestos waste must comply with all Federal, State and County Regulations.

C. Copies of all dump receipts; transportation manifests and other documentation of legal disposal shall be supplied to the BOARD'S Environmental Office as disposal occurs. No payment will be made without such documentation of proper disposal.

D. All bagged asbestos debris must be removed from the work area on a daily basis.

E. Bagged debris may be stored on the premises while awaiting transport to the dumpsite. Storage shall be within a locked, closed container, such as a dumpster

equipped with a lid or top. This container shall be located as directed by the BOARD'S Environmental Office.

XVI. EQUIPMENT:

A. The contractor will have, as needed, a sufficient quantity of scaffolds, ladders, lifts and hand tools. Under no circumstances will the contractor be allowed to use equipment owned by the BOARD.

XVII ASBESTOS CONTAINING MATERIAL (ACM) REMOVAL PROCEDURES

A. Asbestos Containing material removal shall be conducted in a regulated enclosure, including hygiene facilities, with negative pressure ventilation units equipped to provide a minimum one work place air change every fifteen (15) minutes and a negative pressure differential inside the work area equal to, or greater than .02 inches of water column.

B. The product name and Material Safety Data Sheet (MSDS) for all materials must be supplied at the pre-job meeting for the BOARD'S Environmental Office approval. No material change will be permitted without the BOARD'S Environmental Office approval.

C. Removal is not complete until all surfaces are smooth to the extent that a sample cannot be obtained. Patched areas will have to be cleaned such that a sample cannot be obtained by scratching away the material.

D. All surfaces (walls, pipes, floors, etc.) shall be free of any residue. The contractor shall take all precautions to limit the spread of odors outside the area of work.

E. The BOARD reserves the right to review and reject unsuitable work practices at its sole discretion.

F. Materials, not identified for removal in these specifications that are damaged by the contractor, will be repaired and/or replaced and the associated cost deducted from the contractor's retention.

G. Other portions of this facility may be occupied and/or used while the asbestos work is being done. The contractor shall take measures to keep the construction related dust to a minimum. The contractor shall also take measures to prevent his activities from creating a disruption to building and instructional activities. The

BOARD can require the contractor to work evenings if their operation causes disruptions to the daytime building and instructional activities.

XVIII. CLEARANCE TESTING

A. Initial final clearance air testing will be conducted by the company engaged by the BOARD. In the event the initial test shows the average concentration of asbestos of five (5) air samples collected within the containment area are greater than 70 structures per square millimeter 70s/mm^2, the contractor is responsible for all costs associated with the second and subsequent final air clearance tests in the affected "work area" from the contractor's final retention. See item XIX.G below for additional information.

B. Each work area will be treated separately for final clearance air testing. The testing will take place as soon as feasible once abatement work is finished.

C. The contractor shall notify the BOARD's representative at least 48 hours in advance of requesting a final air sampling, in each area. Following the satisfactory completion of a visual inspection by BOARD Personnel, the BOARD will arrange for an air-monitoring professional to aggressively sample the air for airborne asbestos fiber concentrations.

D. Final Clearance Sampling-Transmission Electron Analysis (TEM) shall be used to analyze all final clearance air samples per 40 CFR Part, Appendix A to Subpart E.

1. All clearance Air Samples will be taken using aggressive sampling techniques as follows:
    - Sampling shall not begin until 1 hour after the area is dry with no visible water or condensation remaining (a minimum of 4 hours following encapsulation).
    - Samplers shall be placed at random around the work area. If the work area contains the number of rooms equivalent to the number of required samples based on floor area, a sampler shall be placed in each room. When the number of rooms is greater than the required number of samples a representative sample of rooms shall be selected.
    - The representative samplers placed outside the work area but within the building shall be located to avoid any air that might escape through the isolation barriers and shall be approximately 50 feet from the entrance to the work area, and 25 feet from the isolation barriers.

- In each homogeneous work area after completion of all cleaning work, a minimum of 13 samples will be taken and analyzed as follows:

FINAL CLEARANCE SAMPLING SCHEDULE :

Location Sampled	Number of Samples	Filter Media	Detection Limits Structures/mm^2	Minimum Volume	Rate (LPM)
Work Area	**5**	**MCE**	**70**	**1200**	**6-9.9**
Outside Work Area	**5**	**MCE**	**70**	**1200**	**6-9.9**
Field Blank	**2**	**MCE**	**70**	**1200**	**6-9.9**
Sealed Blank	**1**	**MCE**	**70**	**1200**	**6-9.9**

Release Criteria: Decontamination of the work site is complete if the concentration of all samples is (less than) <70 s/mm^2.

E. Final Clearance Sampling for the soil in each work area shall be conducted by Polarized Light Microscopy (PLM) bulk sampling. Nine (9) bulk sampling shall be conducted in a statically random manner of each work area. Each bulk sample shall be less than one percentage (< 1%).

E. The BOARD reserves the right to require that the work area be re-cleaned, at no additional cost, even if the average concentration of asbestos of five air samples collected in the containment area is less than 70s/mm^2, and the result of any one (1) sample collected within the work area yields a result of 80s/mm^2 or above.

F. The enclosure shall remain intact until final clearance has been obtained and no additional cleaning as specified in Item XIX.G is required. Verbal results will be given to the contractor as soon as the BOARD is given the results; this will be followed up in writing when the results become available.

XIX. ASBESTOS SUBMITTALS:

A. The Contractor shall, submit within two (2) working days, after the apparent low bidder is notified, a qualification statement. This statement will include:

1. Owners of the asbestos removal firm, addresses and telephone numbers.
2. A list of five (5) comparable previous asbestos jobs. The list will include names, addresses, telephone numbers and dates of the jobs
3. Asbestos removal firm's Maryland license to remove or encapsulate asbestos.
4. A statement that the contractor has ample equipment and personnel to perform the work within the time specified
5. Copies of valid Maryland certificates of all asbestos workers and supervisors who will be performing abatement activities
6. The name, addressed phone number of the disposal facility.
7. The name, addresses and phone number of the independent laboratory that the contractor will employ to analyze air samples

END OF SECTION 02080

Division of Supporting Services | Building Services Department |Environmental Office
Environmental Contractors | 2014

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SECTION 02 4100
DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Building demolition Removal of Hazardous material or toxic substances section is adopted by PGCPS and has been added as a separate specification section .

B. Selective demolition of built site elements.

C. Selective demolition of building elements for alteration purposes.

D. Abandonment and removal of existing utilities and utility structures.

1.02 RELATED REQUIREMENTS

A. Section 00 3100 - Available Project Information: Existing building survey conducted by Owner; information about known hazardous materials.

B. Section 01 1000 - Summary: Limitations on Contractor's use of site and premises.

C. Section 01 1000 - Summary: Sequencing and staging requirements.

D. Section 01 1000 - Summary: Description of items to be removed by Owner.

E. Section 01 1000 - Summary: Description of items to be salvaged or removed for re-use by Contractor.

F. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

G. Section 01 5713 - Temporary Erosion and Sediment Control.

H. Section 01 6000 - Product Requirements: Handling and storage of items removed for salvage and relocation.

I. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

J. Section 01 7419 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

K. Section 02 6500 - Underground Storage Tank Removal.

L. Section 02 8400 - Polychlorinate Biphenyl (PCB) Remediation: Removal of equipment containing substances regulated under the Federal Toxic Substances Control Act (TSCA), including but not limited to PCB- and mercury-containing equipment.

M. Section 07 0150.19 - Preparation for Re-Roofing: Removal of existing roofing, roof insulation, flashing, trim, and accessories.

N. Section 31 1000 - Site Clearing: Vegetation and existing debris removal.

O. Section 31 2200 - Grading: Topsoil removal.

P. Section 31 2200 - Grading: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

Q. Section 31 2323 - Fill: Filling holes, pits, and excavations generated as a result of removal operations.

R. Section 32 9300 - Plants: Relocation of existing trees, shrubs, and other plants.

S. Section 32 9300 - Plants: Pruning of existing trees to remain.

1.03 REFERENCE STANDARDS

A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards current edition.

B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations 2013.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Site Plan: Showing:

1. Vegetation to be protected.
2. Areas for temporary construction and field offices.
3. Areas for temporary and permanent placement of removed materials.

C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.

1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
2. Identify demolition firm and submit qualifications.
3. Include a summary of safety procedures.

D. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.05 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Company specializing in the type of work required.

1. Minimum of five years of documented experience.

PART 2 PRODUCTS

2.01 MATERIALS

A. Fill Material: As specified in Section 31 2200 - Grading.

PART 3 EXECUTION

3.01 SCOPE

A. Remove portions of existing buildings in the following sequence:

1. utilities, underground tanks and crawlspaces.
2. foundation walls and footings.
3. slab & structure.

B. Remove paving and curbs as required to accomplish new work.

C. Remove all other paving and curbs within site boundaries.

D. Within area of new construction, remove foundation walls and footings to a minimum of 2 feet (600 mm) below finished grade.

E. Outside area of new construction, remove foundation walls and footings to a minimum of 2 feet (600 mm) below finished grade.

F. Remove concrete slabs on grade as indicated on drawings.

G. Remove underground tanks that contain or once contained petroleum products; fill and bury other types of tanks as indicated on drawings.

H. Remove manholes and manhole covers, curb inlets and catch basins as indicated on drawings.

I. Remove fences and gates as indicated on drawings.

J. Removing items that require special care and coordination is the responsibility of the contractor. Coordinate with A/E team and Owner as required. Scheduling removal is paramount to PGCPS Capital Programs.

K. Remove other items indicated, for salvage, relocation, recycling and fill.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with other requirements specified in Section 01 7000.

B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.

1. Obtain required permits.
2. Comply with applicable requirements of NFPA 241.
3. Use of explosives is not permitted.
4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
5. Provide, erect, and maintain temporary barriers and security devices.
6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
8. Do not close or obstruct roadways or sidewalks without permit.
9. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
10. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

C. Do not begin removal until receipt of notification to proceed from Owner .

D. Do not begin removal until built elements to be salvaged or relocated have been removed.

E. Do not begin removal until vegetation to be relocated has been removed and specified measures have been taken to protect vegetation to remain.

F. Protect existing structures and other elements that are not to be removed.

1. Provide bracing and shoring.
2. Prevent movement or settlement of adjacent structures.
3. Stop work immediately if adjacent structures appear to be in danger.

G. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

H. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner ; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

I. Perform demolition in a manner that maximizes salvage and recycling of materials.

1. Comply with requirements of Section 01 7419 - Waste Management.
2. Dismantle existing construction and separate materials.

3. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

J. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

K. Underground Storage Tanks: Remove and dispose of as specified in Section 02 6500.

3.03 EXISTING UTILITIES

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner .

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner .

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

H. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

3.04 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.

1. Verify that construction and utility arrangements are as indicated.

2. Report discrepancies to Architect before disturbing existing installation.

3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Separate areas in which demolition is being conducted from other areas that are still occupied.

1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 5000 in locations indicated on drawings.

2. Provide sound retardant partitions of construction indicated on drawings in locations indicated on drawings.

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.

D. Remove existing work as indicated and as required to accomplish new work.

1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.

2. Remove items indicated on drawings.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical and Telecommunications): Remove existing systems and equipment as indicated.

1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
3. Verify that abandoned services serve only abandoned facilities before removal.
4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.

F. Protect existing work to remain.

1. Prevent movement of structure; provide shoring and bracing if necessary.
2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.
4. Patch as specified for patching new work.

3.05 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Remove from site all materials not to be reused on site; comply with requirements of Section 01 7419 - Waste Management.

C. Leave site in clean condition, ready for subsequent work.

D. Clean up spillage and wind-blown debris from public and private lands.

3.06 SALVAGE

A. Owner assumes no responsibility for loss or damage to materials or structures on site, salvage value of which Contractor may have reflected in his bid.

END OF SECTION

A. Right of first refusal: All existing items of construction, building materials and furnishings (doors, frames, hardware, windows, chalkboards, tackboards, kitchen, heating ventilation, air conditioning, plumbing and electrical equipment, etc.) located in renovated or altered areas of the project shall be carefully removed without damage and remain the property of the Owner unless indicated for re-use in the new work. Any equipment not desired to be retained by the Owner shall be removed from the site and legally disposed of by the Contractor.

SECTION 02 4113
SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General Conditions and Division 1 Specifications Sections, apply to the Work of this Section, with special attention to the following:

1. Section 01 1000 - Summary
2. Section 01 5000 - Temporary Facilities and Controls
3. Section 01 5100 - Temporary Utilities
4. Section 01 7610 - Temporary Protective Coverings
5. Section 01 7419 - Condruction Waste Management

1.02 RELATED WORK

A. Section 31 1000 - Site Clearing

1.03 REFERENCE STANDARDS

A. Occupational Safety and Health Standards for the Construction Industry (29 CFR Part 1926) as promulgated by OSHA.

1. Subpart D – Occupational Health and Environmental Controls, 1926.62- Lead.
2. Subpart T – Demolition.

B. 2011 Maryland Standards and Specifications for Soil Erosion and Sediment Control

C. Prince Georges County Design Manuals

1.04 WORK EXCLUDED

A. Information related to asbestos abatement/removal and materials and finishes containing asbestos is indicated on the Drawings, and in the school's Asbestos Containing Materials (ACM) Management Plan, available on site. Removal of asbestos containing materials shall be performed by a licensed asbestos abatement/removal contractor retained by the Owner, except as noted in 1.06 below

B. It shall be the responsibility of the Contractor to notify the Owner prior to initiating selective demolition in existing building areas where the presence of asbestos has been identified. Selective demolition shall not commence until asbestos- containing material has been removed.

C. The Contractor shall include a time allowance for notification and abatement/removal operations for identified ACM in his work schedule.

1. A minimum 20-day notification to the MDE and is required where removal and disturbance of more than 10 LF per 10 SF of ACM is required.

1.05 CONTRACTOR QUALIFICATIONS

A. The Contractor shall have personnel on site during performance of selective demolition who are trained to identify ACM and other hazardous material, and who are familiar with removal procedures for non asbestos containing hazardous materials (See 1.06 below). The Contractor shall provide evidence of certification for these personnel.

1.06 DESCRIPTION OF WORK

A. General:

1. Remove and legally dispose of all equipment and materials indicated on the drawings, including those items that contain regulated hazardous materials, including asbestos containing materials (ACM) as noted below. Regulated hazardous materials shall require specialized disposal in accordance with applicable regulations. The Contractor will coordinate the scheduling of the removal of all hazardous materials with the Owner and provide the Owner with documentation that the hazardous waste is disposed at an authorized waste disposal facility.
    a. Regulated hazardous materials include the following:
        1) Fluorescent lamps and PCB containing ballasts.
        2) Lead paint, putty and sealants in windows/frames.
        3) Metal primer on structural steel and steel windows.
        4) CFC type refrigerants such as R-12 (“Freon”).
        5) The Contractor must coordinate removal activities to allow the Owner to schedule the presence of a project monitor. Provide the Owner with documentation that the ACM waste generated is disposed at an authorized waste disposal facility.
        6) Wood utility poles treated with creosote.

B. Performance of Work
1. Construction of the proposed work will be performed while school is in use. The Contractor shall give full cooperation to the school administration and staff in scheduling and performing the work.
2. The Contractor shall provide, install and maintain safety and dust barriers as required by applicable health and safety regulations and as specified in Section 01520.
3. The Contractor shall schedule his work and deliveries so as not to interfere with the normal operation of the school, including morning arrivals and afternoon departures.
4. The Contractor shall give seventy-two hours advance written notice to Owner when work is to be performed that might endanger and inconvenience occupants.
5. The Contractor shall provide all erosion and sediment control devices as required by site inspector, owner, owner’s agent, architect or engineer.
6. The Contractor shall keep open, protect and maintain all existing fire exits and fire lanes during the entire course of construction.

C. Protection
1. Erect barriers, fences, guard rails, enclosures, chutes, and shoring to protect personnel, structures, and utilities remaining intact.

D. Maintaining Traffic
1. Minimize interference with normal use of roads, streets, driveways, sidewalks, and adjacent facilities.
2. Do not close or obstruct streets, sidewalks, alleys, or passageways without written permission from authorities having jurisdiction.
3. If required by governing authorities, provide alternate routes around closed or obstructed traffic ways.

1.07 DEFINITIONS

A. Chain of Custody: a system that tracks a product, its materials and components through two or more life cycle stages

PART 2 – PRODUCTS – NOT USED

A. Closed-loop Life Cycle: a product and/or constituent material(s) life-cycle where the product or constituent material(s) are reused, repurposed (reused for a different purpose), recycled, composted, or otherwise treated as a useful resource that minimizes waste and negative environmental impacts.

B. Custodian: a single person with primary responsibility for the care and custody of the product until primary possession of the product is transferred.

C. Deconstruction: Disassembly of buildings for the purpose of recovering materials.

D. Extended Producer Responsibility: a strategy designed to promote the integration of environmental costs associated with products throughout their life cycles into the market price of the products. Extended producer responsibility imposes accountability over the entire life cycle of products and packaging introduced on the market.

2.02 SUBMITTALS

A. A. Schedule of items and materials to be salvaged. Identify procedures for disassembly.

1. Coordinate with Solid Waste Management Plan. Identify materials to be recycled. Identify materials to be salvaged for reuse on site and off site.

B. Documentation of manufacturers' take-back and buy-back programs in support of a closed-loop life cycle:

1. Take-Back Agreements: Submit copy of each manufacturer's written commitment to reclaim product at product's end-of-life or when purchaser requests to return the product, whichever is earlier.

   a. Commitment shall specify that producer's reclamation shall be conducted in an environmentally responsible manner.

   b. Indicate whether manufacturer reclaims only their products or similar competitor products.

   c. Identify any parameters, limitations, and conditions that may apply.

2. Buy-Back Agreement: Submit copy of each manufacturer's written commitment to repurchase product at product's end-of-life or when purchaser requests to return the product, whichever is earlier.

   a. Commitment shall specify that producer's reclamation shall be conducted in an environmentally responsible manner.

   b. Commitment shall specify a financial value for repurchase of product. Value may be extended in one or more of the following: monetary exchange, credit towards future purchase, or other tangible consideration.

   c. Indicate whether manufacturer repurchases only their products or similar competitor products.

   d. Identify any parameters, limitations, and conditions that may apply

3. Chain-of-Custody: Submit chain-of-custody documentation to verify that products have been salvaged from project and satisfactorily transferred and accepted for reclamation by manufacturer. Indicate:

PART 3 - EXECUTION

   a. Description of product: Manufacturer name, product name and description.

   b. Quantity of product.

   c. Custodian Information - Sender:

      1) Contact information for sending custodian including name, title, organization, address, phone, and email.

2) Date and time product was sent.

3) Condition of product.

d. Custodian Information - Receiver:

1) Contact information for sending custodian including name, title, organization, address, phone, and email.

2) Date and time product was sent.

3) Condition of product.

3.02 QUALITY ASSURANCE

A. Handle waste materials as specified in Section 01 74 19 – Construction Waste Management.

3.03 INSPECTION

A. Verify that areas to be demolished are unoccupied and discontinued in use.

B. Verify that all utilities within the area to be demolished have been cut off and capped.

C. Do not commence work until conditions are acceptable to Architect and Owner.

3.04 PREPARATION

A. Remove items scheduled to be salvaged for Owner, and place in designated storage area. (See 3.05, Salvage).

3.05 DEMOLITION

A. Demolition shall be carried out with care so that portions of building that are to remain will be undamaged. Work on exterior of building shall be done with extreme care to prevent risk or harm to persons or property. Install temporary floors consisting of sisal kraft paper over existing floors that are to remain in areas of work. Do not allow debris to accumulate.

B. Coordinate demolition with work of other trades. Supervise and assist in removal and replacement of existing materials for installation of new mechanical and electrical items. Remove and replace or re-route mechanical, electrical installation as indicated on the drawings and specified or required for installation of new work or remodeling.

C. Walls

1. At areas where windows are removed, protect adjacent work which shall remain.

2. Where openings are cut in walls, such openings shall be cut with care to avoid damage to work that shall remain.

3. Infill masonry shall be toothed, with the exception of face brick which shall be flush vertically with adjoining existing work.

4. New work shall be carefully installed with materials that match existing, and shall conform to existing planes unless indicated otherwise.

D. Finishes

1. Existing ceiling, wall and floor finish or trim that is disturbed or destroyed by these operations shall be replaced to abut adjoining walls, floors, ceiling and new construction with material to match existing.

2. At locations where existing tile floors are disturbed by new construction, existing tile shall be removed to nearest tile joint that parallels new construction and shall be replaced.

E. Connecting work and new work in extension of existing work shall correspond in all respects with that to which it connects, or similar existing work, unless otherwise indicated or specified. Existing work shall be cut, drilled, altered or temporarily removed and replaced as necessary for performance of Contract.

F. No structural member shall be cut or altered without written authorization of Architect.

G. Work remaining in place that is damaged or defaced by work under this contract shall be restored to the original condition at the time of award of contract.

H. If removal of existing work exposes discolored, unfinished surfaces or work out of alignment, such surfaces shall be refinished or material replaced as necessary to make contiguous work uniform and harmonious.

3.06 DISPOSAL

A. Remove demolition debris daily.

B. Do not store or burn materials on site.

C. Transport demolition debris to off-site legal disposal facilities.

1. Hazardous materials such as fluorescent lamps and PCB-containing ballasts shall be disposed of at special collection centers offering specialized recycling and treatment procedures.

3.07 SALVAGE

A. Owner assumes no responsibility for loss or damage to materials or structures on site, salvage value of which Contractor may have reflected in his bid.

B. Right of first refusal: All existing items of construction, building materials and furnishings (doors, frames, hardware, windows, chalkboards, tackboards, kitchen, heating ventilation, air conditioning, plumbing and electrical equipment, etc.) located in renovated or altered areas of the project shall be carefully removed without damage and remain the property of the Owner unless indicated for re-use in the new work. Any equipment not desired to be retained by the Owner shall be removed from the site and legally disposed of by the Contractor.

3.08 DECONSTRUCTION

A. Inspect and evaluate for reuse existing structures on site.

B. Disassemble existing construction scheduled to be removed for recycling or reuse, including reclamation by manufacturers' take-back and buy-back programs.

C. Demolition will not be permitted [unless approved in writing by Owner].

D. Salvage materials for recycling and reuse as indicated on drawings.

1. Materials scheduled for reuse on site include: [xxxx].

2. Materials scheduled for reuse off site: As specified in Section 01 74 19 (01351) – Construction Waste Management.

3. Materials scheduled for recycling off site: As specified in Section 01 74 19 (01351) – Construction Waste Management.

4. Materials scheduled for manufacturers' take-back and buy-back programs: [xxxx]

END OF SECTION

SECTION 02 4300
STRUCTURE MOVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preparing structure for move.

B. Moving structure to new location.

C. Setting structure on new foundation.

D. Disconnecting and capping utilities at original location.

E. Connecting utilities at new location.

1.02 RELATED REQUIREMENTS

A. Section 02 4100 - Demolition: Removal of existing foundation after structure removal.

B. Section 31 2200 - Grading: Rough and finish grading.

C. Section 31 2316 - Excavation: Excavating at perimeter of existing foundations in preparation for move.

D. Section 31 2316 - Excavation: Excavating at new site.

E. Section 31 2323 - Fill: Fill materials.

F. Section 31 2323 - Fill: Backfilling against foundation walls at new site.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Arrange for route of move with authorities having jurisdiction and comply with its requirements for the move including, but not limited to, traffic control, police escorts, and relocation of overhead utility services in the route.

B. Coordination: Ensure utilities at new location are ready for connection.

C. Pre-Move Meeting: Convene one week before starting work of this section. Discuss the following:

1. Method of determining damage to existing structure and finishes before and after the move.
2. Identify existing damage to sidewalks, roads, and curbs.
3. Method and responsibility for repairs after moving.
4. Review the intended route for moving and dimensional clearances of obstructions.
5. Coordination with affected utility companies.
6. Coordination with authorities for permits, municipalities affected, and traffic control.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Project Record Documents: Record actual locations of new utilities and services, foundations .

1.05 QUALITY ASSURANCE

A. Mover Qualifications: Company specializing in relocating building structures with minimum of three years of documented experience.

B. Retain services of a Professional Structural Engineer experienced in this Work and licensed in Maryland for the following:

1. To investigate and provide documented report confirming load bearing capacity of roads over which structure will be moved.

2. To design structural supports for existing structure and associated Work. Design framing, reinforcement, and brace connections to transfer loads of structure to transport carrying timbers.

PART 2 PRODUCTS

2.01 EQUIPMENT AND MATERIALS

A. Transport, Equipment, and Supports: As required to achieve a successful structure move.

B. Fill Materials: As specified in Section 31 2323.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify availability and accessibility of transport routes. Verify route load limits to ensure conditions are adequate to support moving loads of structure.

B. Identify utility services and obstructions to be removed, relocated, or abandoned during progress of the Work.

C. Damage Determination:

1. Before the move, inspect existing structure thoroughly and notify Architect in writing of visible defects and factors that could affect safe movement of structure to final location.

2. Compile list of existing visible defects to building structure, finishes, accessories . This list will form the basis for determining required repair work after the move.

3. Photograph interior surfaces for record purposes.

3.02 PREPARATION

A. Prepare site, route of transport, and destination site.

B. Reinforce road as necessary to safely move the structure and to prevent damage.

C. Coordinate the work of municipal utility disconnection and reconnection with the work of this section.

D. Disconnect and cap existing site utility services. Remove overhead or exposed utility services to provide clear working and moving space around and below structure.

E. Remove building protrusions prior to move.

F. Secure supplementary framing and bracing to structure.

G. Secure operating, moving, or suspended items such as doors, windows, and light fixtures in a manner to prevent damage to items or to the structure during move.

H. Protect elements surrounding the structure from damage.

3.03 RAISE STRUCTURE

A. Cut structure free of foundation and portions of structure not being moved.

B. Reinforce, brace, and raise structure clear of foundation in manner to prevent damage.

C. Provide necessary framing, bracing, closures, supports, and blocking.

D. Secure structure to temporary supporting structural members to prevent shifting of structure during move.

3.04 MOVE STRUCTURE

A. Provide transport vehicles for moving structure to new site.

B. Move structure, control speed, and provide anchor and restraining devices to maintain the integrity of the structure.

C. During move, protect adjacent structures, and private and public property from damage.

3.05 REINSTALL STRUCTURE

A. Position and anchor structure over prepared foundation and lower onto new foundation.

B. Remove moving equipment.

C. Leave reinforcing, framing, and bracing intact until structure is fully attached and structure loads are supported by new foundation.

D. Reinstall building protrusions removed prior to move.

3.06 TOLERANCES

A. Maximum Variation from Level and Plumb After Reinstallation: 1/4 inch (6 mm).

B. Maximum Offset from True Position After Reinstallation: 1/4 inch (6 mm).

C. Adjust structure on foundation:

1. To permit doors to swing freely.
2. So that floor surfaces are level, walls are plumb.

3.07 DAMAGE REPAIR

A. Repair damage to structure not identified in writing prior to move.

B. Refinish repaired surfaces to match adjacent work.

C. Pay all third party claims for incidental or other damage.

3.08 CLEANING

A. Remove moving equipment and materials from original site, final site, and route of travel.

B. Remove road base constructed by this section, fill and return grades and contours to original condition and dimension.

END OF SECTION

SECTION 02 6500
UNDERGROUND STORAGE TANK REMOVAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Removal and disposal of underground storage tanks and connected piping.

B. Cleaning and vapor freeing of tanks.

C. Fuel removal.

D. Temporary containment of excavated soil.

E. Testing soils for contamination.

F. Disposal of contaminated soil.

G. Water disposal.

H. Providing reports required by regulatory agencies.

I. Backfilling.

1.02 RELATED REQUIREMENTS

A. Section 01 7000 - Execution and Closeout Requirements: Dewatering of excavations and water control.

B. Section 02 4100 - Demolition.

C. Section 31 2200 - Grading: Soil removal from surface of site.

D. Section 31 2323 - Fill: Fill materials, filling, and compacting.

1.03 PRICE AND PAYMENT PROCEDURES

A. See Section 01 2200 - Unit Prices, for general requirements applicable to unit prices related to removal and disposal of underground storage tanks.

B. Unit Prices: Assume for bidding purposes that concrete slabs, bituminous pavement, soil and water encountered during the removal of the underground tanks are contaminated with JP-5 fuel oil and shall be handled as specified herein.

1. Payment for removal from temporary stockpile and disposal of contaminated soil and furnishing clean soil shall be paid for at the contract unit price per cubic yard (cubic meter).

2. Bituminous pavement and concrete slabs shall be washed and disposed of as demolition debris. Wash water shall be collected and stored.

3. Disposal of contaminated water shall be paid for at the contract unit price per liter (gallon).

1.04 REFERENCE STANDARDS

A. API RP 1604 - Closure of Underground Petroleum Storage Tanks 1996 (R2010).

B. 29 CFR 1910 - Occupational Safety and Health Standards current edition.

C. 29 CFR 1910.38 - Emergency action plans current edition.

D. 29 CFR 1910.134 - Respiratory protection current edition.

E. 40 CFR 280 - Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks current edition.

F. COE EM-385-1-1 - Safety and Health Requirements Manual 2008.

G. EPA SW-846 - Test Methods for Evaluating Solid Waste, Physical/Chemical Methods Current Edition.

H. EPA 600-4-790-20 - Methods for Chemical Analysis of Water and Wastes 1983.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Site Safety and Health Plan: Describe safety and health plan and procedures as related to underground tank removal and pipe removal, and as related to operations associated with petroleum contaminated soils and water.

C. Excavation and Material Handling Plan: Describe methods, means, equipment, sequence of operations and schedule to be employed in excavation, transport, handling, and stockpiling of soil during underground tank removal.

1. Submit to Architect fifteen days before beginning tank removal work.
2. Include a material handling plan that describes phases of dealing with the contaminated soil and water as it relates to the proposed tank and piping removal.
3. Include methods of excavating, a material handling plan for the contaminated material, soil testing requirements, safety precautions and requirements and water pumping and collection requirements.

D. Field Sampling and Laboratory Testing Plan: Describe field sampling methods and quality control procedures.

1. Identify laboratory and laboratory methods to be used for contamination testing.
2. Sample reports shall show sample identification for location, date, time, sample method, contamination level, name of individual sampler, identification of laboratory, and quality control procedures.

E. Tank and Piping Removal and Disposal Plan: Describe methods, means, sequence of operations, and schedule to be employed in the testing, pumping, cleaning, de-vaporizing, inspecting, removal, and disposal of underground storage tanks and piping.

F. Spill and Discharge Control Plan: Describe procedures and plan related to potential spills and discharge of contaminated soils and water.

G. Reports:

1. Identification of tanks removed and disposed of, including site map showing location of tank and piping.
2. Starting and ending dates of reporting period.
3. Closure report. Incorporate reports, records, and data into a single binder with the title "SITE ASSESSMENT REPORT" on the cover of the binder.
4. Laboratory testing reports, including location of soil excavated and associated OVA/FID (organic vapor analyzer/flame ionization device) readings, and sampling and test results for:
    a. TPH (total petroleum hydrocarbons).
    b. BTEX (benzene, toluene, ethylbenzene, and xylene).
    c. TCLP (toxicity characteristic leaching procedure); if BTEX indicates gasoline, then provide TCLP.
5. Cumulative quantities of soil excavated, beginning with start date for each tank and associated piping.

H. Record Documents:

1. Building permit, inspection permits, and other permits required for underground tank removal.

2. Results of excavation, including sketch showing location of underground storage tank, sampling locations, and extent of excavation.
3. Tank disposal paperwork, such as copy of UST Notification Form and method of conditioning tank for disposal.
4. Contaminated soil disposal paperwork, such as laboratory testing reports.
5. Contaminated water disposal paperwork, such as laboratory testing results.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with local, state, and federal regulations and 40 CFR 280.

B. Qualifications: Prior to start of work, submit documentation of recent experience and resumes of personnel working on the project.

1. Data shall indicate that tank removal contractor, subcontractors, and personnel employed on the project have been engaged in removal, transportation, and disposal of underground tanks and associated piping, are familiar with and shall abide with the following:
   a. API RP 1604.
   b. 40 CFR 280 and State and local regulations and procedures.
   c. Applicable safety rules and regulations.
   d. Use of equipment and procedures for testing and vapor-freeing tanks.
   e. Handling and disposal of types of wastes encountered in underground tank and pipe removal including disposal of underground tanks and associated piping.
   f. Excavation, testing, and disposal of petroleum contaminated soils, liquids, and sludge.
   g. Provide documentation that tank removers are certified if locality of project has this requirement.
2. Furnish the name and qualifications of the proposed Site Safety and Health Officer, based on education, training, and work experience.

C. References: Furnish data proving experience on at least three prior projects that included types of activities similar to those in this project. Provide project titles, dates of projects, owners of projects, point of contact for each project, and phone numbers of each point of contact.

PART 2 PRODUCTS

2.01 MATERIALS

A. Plastic Sheeting: ASTM D4397.

PART 3 EXECUTION

3.01 PREPARATION FOR TANK REMOVAL AND DISPOSAL

A. Site Safety And Health Plan (SSHP): Furnish safety, health, and accident prevention provisions and develop a Site Safety and Health Plan (SSHP).

1. The SSHP shall incorporate the requirements of 29 CFR 1910 and COE EM-385-1-1.
2. Site work shall not start until the SSHP is approved by the Architect .

B. Site Safety And Health Officer: Identify an individual to serve as the Site Safety and Health Officer (SSHO) who is a Certified Industrial Hygienist (CIH).

1. The SSHO CIH shall report problems and concerns regarding health and safety to the Architect .

2. The SSHO CIH shall have a working knowledge of local and Federal occupational safety and health regulations, and shall provide training to Contractor employees in air monitoring practices and techniques.
3. The SSHO CIH shall also provide day to day industrial hygiene support, including air monitoring, training, and daily site safety inspections.
4. The SSHO CIH shall be trained in the use of the monitoring and sampling equipment, interpretation of data required to implement the SSHP, and to administer the elements of the SSHP.
5. The SSHO CIH shall remain on site during project operations and may be assigned other duties, such as project foreman or quality control manager.

C. Spill And Discharge Control Plan: Develop, implement, and maintain a comprehensive spill and discharge control plan.
1. The plan shall provide contingency measures for potential spills and discharges from handling and transportation of contaminated soils and water.
2. A possible source of guidance for assessment and remediation is API PUBL 1628.

D. Exclusion Zone (EZ) And Contamination Reduction Zone (CRZ): Do not permit personnel not directly involved with the project to enter work zones, called the EZ and CRZ.
1. The EZ shall be an area around the tank a minimum of 10 feet (3 m) from the limits of the tank excavation.
2. At the perimeter of the EZ, establish a CRZ.
3. The Contractor 's site office, parking area, and other support facilities shall be located outside the EZ and CRZ.
4. Clearly mark and post the boundaries of the EZ and CRZ.
5. Include a site map, outlining the extent of work zones and location of support facilities, in the SSHP.

E. Training: Provide health and safety training in accordance with 29 CFR 1910 prior to starting work.
1. Furnish copies of current training certification statements for personnel prior to initial entry into the work site.
2. On-Site Training: Prior to starting on-site work, a health and safety training class shall be held by the SSHO CIH to discuss the implementation of the SSHP.
3. Notify the Architect 24 hours prior to beginning the training class.
4. Training Outline: Provide the following:
    a. Health and safety organization, including discussion of distribution of functions and responsibilities
    b. Organization and components of the SSHP
    c. Physical and chemical site hazard identification
    d. Basic toxicology and toxicity information
    e. Discussion of the EZ and CRZ
    f. Protective clothing
    g. Respiratory protection
    h. Air quality monitoring
    i. Personnel exposure guidelines

j. Decontamination procedures

k. Basic first aid review

l. Emergency procedures and contingency plan

m. Site entry and exit procedures

n. Sampling procedures

F. Personnel Protection: Furnish appropriate personal safety equipment and protective clothing to personnel.

1. Ensure that safety equipment and protective clothing is kept clean and well maintained.

2. Furnish three clean sets of personal protective equipment and clothing for use by the Architect or official visitors as required for entry into the EZ.

G. Respiratory Protection Program: Develop a respiratory protection program, addressing respirator usage and training, in accordance with 29 CFR 1910.134 and COE EM-385-1-1.

H. Decontamination: Decontaminate or properly dispose of personal protective equipment and clothing worn in contaminated areas at the end of the work day.

1. The SSHO CIH shall be responsible for ensuring that personal protective clothing and equipment are decontaminated before being reissued.

I. First Aid And Emergency Response Equipment And Procedures: Provide appropriate emergency first aid equipment for treatment of exposure to site physical and chemical hazards.

1. Provide and post a list of emergency phone numbers and points of contact for fire, hospital, police, ambulance, and other necessary contacts.

2. Provide and post a route map detailing the directions to the nearest medical facility.

J. Ignition Sources: Do not permit ignition sources in the EZ and CRZ.

K. Personnel And Equipment Decontamination: Decontaminate personnel and equipment before exiting the work zones.

L. Waste Disposal: The SSHP shall detail the practices and procedures to be utilized to dispose of wastes. Upon completion of the project, certify that equipment and materials were properly decontaminated prior to being removed from the site.

M. Emergency Response Requirements: Furnish emergency response and contingency plan in accordance with 29 CFR 1910.38.

1. In an emergency, take action to remove or minimize the cause of the emergency, alert the Architect , and institute necessary measures to prevent repetition of the emergency.

2. Equip site-support vehicles with route maps providing directions to the medical treatment facility.

N. Unforeseen Hazards: Notify the Architect of any unforeseen hazard or condition that becomes evident during work.

3.02 TANK CLEANING

A. Provide clean and vapor free tank in accordance with API RP 1604 and the following Table of Tank History:

B. Fuel Removal:

1. All possible fuel will be pumped or otherwise removed from the tank by Owner .

2. Consider remaining fuel contaminated or waste fuel; pump into 55 gallon (208 liters) drums or other suitable containers for disposal in accordance with approved procedures meeting local, state, and federal regulations.
    a. Drums or tanks used for containerizing waste fuel shall be furnished by Contractor .
3. Dispose of remaining fuel emulsions in accordance with applicable local, state, and federal regulations.

3.03 TEMPORARY CONTAINMENT OF EXCAVATED SOIL

A. Provide temporary containment area near the excavated area.

B. Cover containment area with 30 mil (0.75 mm) polyethylene sheeting.
1. Place excavated soil on the impervious barrier and cover with 6 mil (0.15 mm) polyethylene sheeting.
2. Provide straw bale berm around the outer limits of the containment area and cover with polyethylene sheets.
3. Secure edges of sheets to keep the polyethylene sheeting in place.

3.04 EXCAVATION

A. Provide Architect with written documentation, no later than 30 days before work begins, that proper state or local authorities have been notified.

B. Notify Architect at least 48 hours prior to start of tank removal work.
1. Stage operations to minimize the time that tank excavation is open and the time that contaminated soil is exposed to the weather.
2. Provide protection measures around the excavation area to prevent water runoff and to contain the soil within the excavation area.

C. Excavation: Excavate as required to remove tanks and piping.
1. Place soil removed from the excavation in a temporary containment area.
2. Collect and temporarily store water runoff from stockpiled soils.
3. Contaminated soil materials may be used as backfill for tank and pipe excavations as follows:
    a. To determine soil contamination levels, continuously monitor soil materials excavated to remove tanks with an OVA/FID capable of detecting volatile organic vapors to a minimum of one ppm.
    b. Contaminated soils with OVA/FID readings of 10 ppm or greater shall be further tested for TPH and BTEX as specified herein.
    c. Soils with OVA/FID readings less than 10 ppm may be used as clean backfill.
    d. Dispose of unacceptably contaminated soils in accordance with federal, state, and local regulations.

D. Excavation Methods: Select methods and equipment to remove soil to minimize disturbance to areas beyond the limits of the excavation area.
1. Material that becomes contaminated as a result of Contractor 's operations shall be removed and disposed of at no additional cost to Owner .
2. Where excavation extends into groundwater levels, dewatering methods shall be employed on a localized basis to facilitate excavation operations, as specified in Section 01 7000.

3. Water generated by dewatering during excavation required for removal of tanks or piping, surface water collected in open excavation, or water used for washing equipment or existing concrete or bituminous surfaces, shall be collected and tested.
    a. Test in accordance with EPA SW-846 and EPA 600-4-790-20 and state or locally required analyses.
    b. Water that contains contaminants above locally acceptable levels shall be disposed of in accordance with federal, state, and local regulations.
    c. Non-contaminated water may be disposed of on-site.

E. Structures: During excavation activities, if asphalt pavement, concrete slabs, or other structures are encountered, remove and wash with high pressure water cleaning equipment.
1. Remove and dispose of pavement, concrete, and other structures as specified in Section 02 4100.

3.05 TESTING

A. Stockpiled Soils: Soils with OVA/FID readings of 10 ppm or greater shall be further sampled and tested.
1. Test for TPH and for BTEX in accordance with EPA SW-846 and EPA 600-4-790-20.
2. Test for toxicity characteristic leaching procedure (TCLP) for lead if leaded gasoline was stored in or near the underground tank being removed.
3. For TPH, provide a minimum of one test for every 100 cubic yards (77 cubic meters).
4. For BTEX and TCLP, provide one test for every 100 cubic yards (77 cubic meters).
5. Soils that contain 50 ppm or more TPH, 10 ppm or more BTEX or have TCLP reading of 10 ppm lead or virgin petroleum products are considered contaminated materials.
6. Soils that test at levels less than the above may be used as clean fill.
7. Furnish results to Architect within 24 hours after the results are obtained.

B. Testing Under Tank After Removal of Tank:
1. If tank is 20 feet (6 m) or less in length, take two samples. Each sample shall be 2 feet (0.60m) from each end of the tank and 2 feet (0.60 m) below the bottom of the excavation.
2. If the tank is greater than 20 feet (6 m), take three samples. Two samples shall be 2 feet (0.60 m) from each end of the tank and 2 feet (0.60 m) below the bottom of the excavation. A third sample shall be taken from the middle of the tank area and 2 feet (0.60 m) below the bottom of the excavation.
3. Analyze samples for TPH, BTEX, and TCLP.
4. Comply with standards for sampling and analysis as specified above for stockpiled soils.
5. Test for TPH and for BTEX in accordance with EPA SW-846 and EPA 600-4-790-20.
6. Soils that contain 50 ppm or more TPH, 10 ppm or more BTEX, or have TCLP reading of 10 ppm of lead or virgin petroleum products are considered contaminated materials.
7. Soils that test at levels less than the above may be used as clean fill.
8. Furnish results to Architect within 24 hours after the results are obtained.
9. Along with the results furnish a sketch showing underground tank, sampling location, and extent of excavations.

C. Testing Along Piping:

1. For every 25 linear feet (7.5 m) of product delivery piping, for every change in direction, and at every mechanical joint take one soil sample and analyze for TPH, BTEX, and TCLP.
2. Comply with requirements for sampling and analysis of soil materials as specified above in the paragraph entitled "Testing Under Tank After Removal of Tank."

3.06 WATER DISPOSAL

A. Dewatering will be permitted only with approval of Architect .

B. Store and test water generated during removal of tanks and piping.

1. If contaminated, transport and dispose of water in an EPA approved disposal site in accordance with federal, state, and local requirements.
2. Non-contaminated water may be disposed of on-site.

3.07 DISPOSAL OF UNDERGROUND TANKS, ANCHORS , SLABS, AND ASSOCIATED PIPING

A. Preparation: API RP 1604. Remove the fill pipe, gage pipe, vapor recovery truck connection, submersible pumps, and drop tube.

1. Cap or remove non-product piping, except vent piping.
2. Plug tank openings so that vapors will exit through vent piping during the vapor-freeing process.

B. Purging: Remove flammable vapors in accordance with API RP 1604. Tanks shall be certified as "vapor free" prior to further work.

C. Cleaning and Testing: Clean tank and perform atmosphere testing in accordance with API RP 1604.

1. Distribution (product delivery) piping shall be cleaned and removed or the piping shall be cleaned, filled with concrete, and abandoned in place.
2. Test the tank atmosphere and the excavation area for flammable or combustible vapor concentrations, with a combustible gas indicator until the tank is removed from the excavation and from the site.

D. Tank Removal and Disposal:

1. Plug or cap accessible holes. One plug shall have a minimum 1/8 inch (3 mm) vent hole.
2. Remove tank from the excavation, place it on a level surface and render it useless in accordance with API RP 1604.
3. Provide warning labels on tank if tank contained leaded fuels, as follows:
    a. "TANK HAS CONTAINED LEADED GASOLINE -- NOT VAPOR FREE -- NOT SUITABLE FOR STORAGE OF FOOD OR LIQUIDS INTENDED FOR HUMAN OR ANIMAL CONSUMPTION -- DATE OF REMOVAL: MONTH/DAY/YEAR"
4. Transport and dispose of tank at an EPA approved disposal site in accordance with federal, state, and local regulations.

3.08 INSPECTIONS

A. Arrange for and perform required inspections. Provide copies of inspections to the Architect .

3.09 CLOSURE REPORT (SITE ASSESSMENT REPORT)

A. Provide Architect a Site Assessment Report in a single binder notebook that contains the full collection of reports relating to this work, including but not limited to, records, starting and ending dates of reporting period, inspections, documentation, and data as follows:

1. Complete UST Notification Form (within 30 days of closure).

2. Description of work, including removal procedures, number of tanks removed, identification of tanks removed and disposed of, cubic yards of excavated soil, location of disposal sites, and dates of excavation.
3. Site plan, including location of tanks and piping, limits of excavation, sampling points, results of excavation, and depths.
4. Laboratory testing reports, copies of data and test results from testing laboratory.
5. Tank disposal paperwork, contaminated soil disposal paperwork, and contaminated water disposal paperwork.
6. Certifications required by implementing agency.
7. Building permit, inspection permits, and other permits required for underground tank removal, notifications, and inspection reports.
8. Cumulative quantities of soil excavated, beginning with start date for each tank and associated piping.

3.10 SPILLS OF CONTAMINATED SOILS

A. Use appropriate vehicles and operating practices to prevent spillage or leakage of contaminated materials from occurring during operations. Inspect vehicles leaving the area of contamination to ensure that no contaminated materials adhere to the wheels or undercarriage.

3.11 BACKFILLING

A. Provide backfill, compaction, grading, and seeding in accordance with 31 2323.

B. Line the excavation with two plastic sheets before backfilling.

END OF SECTION

SECTION 02 8213
ASBESTOS ABATEMENT

PART 1 GENERAL

1.01 SCOPE OF WORK: ASBESTOS ABATEMENT

A. Base Bid: The Base Bid shall include the total cost of all asbestos abatement work described. This work shall be performed in accordance with this Section, the plans, all other bid documents, and all federal and state regulations.

B. PGCPS requires all Asbestos Abatement to be performed by a PGCPS Approved Vendor. Coordinate with PGCPS Environmental Department for a list of pre-approved vendors.

C. The contractor will provide all labor, materials, equipment, supervision, testing, permits and all other incidentals required to remove the asbestos containing materials (ACM) listed within these specifications from the areas indicated on the drawings and as described as follows:

1. The contractor shall, completely remove all asbestos containing mastic/caulking associated with wallboards, cement sinks, pipe insulation, duct insulation, floor tile, windows, and mastic in the areas indicted in the drawings.

2. Completely remove all asbestos containing acoustical ceiling tile. Contractor will replace all abated acoustical ceiling tile.

3. Remove all other ACM material encountered and or exposed during project work or involving connection to existing concealed building utilities.

D. The Abatement Contractor shall provide the complete isolation of the work area(s) as needed, and for the total cleaning and decontamination of the area(s) such that no airborne or residual asbestos remains in accordance with the applicable regulatory provisions. The contractor shall be responsible for the proper removal, storage, transportation and disposal of asbestos waste. No waste or debris will be placed in any BOARD owned dumpster or refuse container.

E. The Abatement Contractor can use existing electrical receptacles to operate their equipment. Any electrical work required by the contractor (moving light fixtures, installing “pigtails” for equipment, etc.) must be completed by a contractor, licensed to perform electrical work in Prince Georges County, Maryland. Prices for performing such work shall be incorporated in the total job cost submitted.

F. The BOARD will contract a BOARD approved independent air monitoring company to conduct daily air sampling, final visual inspection and subsequent clearance air and bulk sampling as described in Article X of this document.

G. The contractor will retain primary responsibility for all means, methods, sequencing and coordination during the asbestos abatement phase. Responsibility for the preparation, accuracy, and execution of any drawings or work plans remains with the Contractor. The contractor shall communicate with the general contractor in order to secure access to power, water, telephone and other utilities as part of his bid.

H. This document addresses only the ACM that is associated with the actual work areas. This serves as notice that some materials in other areas within the facility, also has been identified as ACM. It is the General Contractor’s responsibility to review the Asbestos Management Plan for each School and familiarize his employees, inclusive of all Subcontractors, that ACM is present and the possible locations that it may be encountered. Any and all work that involves handling of ACM must be conducted by the asbestos contractor, approved by the BOARD.

I. The cost of any planned or un-planned clean-up activity, inclusive of all school system personnel salaries, required relative to ACM being disturbed by abatement, demolition or construction activities, shall be borne by the Asbestos Contractor.

1.02 REGULATIONS:

A. All work must comply with all applicable Federal, State and County regulations. Work performed in this building falls within the regulatory authority of the Asbestos Hazard Emergency Response Act (AHERA). All workers and supervisors are required to be AHERA certified.

B. All employees performing work on this project must be accredited as required by the Federal AHERA regulations and certified to remove asbestos under the Maryland COMAR Regulations. Appropriate AHERA accreditation must be held by all workers, supervisors and project designers.

C. The successful bidder shall ensure that an Abatement Supervisor (as described in the AHERA Regulations) is on-site at all times during any asbestos removal activity that is conducted during this project. The Supervisor shall be able to present accreditation documents for all workers.

D. All work must comply with the following Federal and State regulations which govern asbestos abatement work or hauling and disposal of asbestos waste materials including but not limited to the following:

1. Environmental Protection Agency (EPA) including but not limited to:
    a. Asbestos Abatement Projects Rule CFR Part 762 TS 62044, FRL 2843-9 Federal Register, Vol 50 No 134, July 12,1985 8530-28540
    b. Regulation for Asbestos Title 40, Part 61, Subpart A of the Code of Federal Regulations
    c. National Emission Standard for Asbestos Title 40, Part 61, Subpart M (Revised Subpart B) of the Code of Federal Regulations
2. Department of Labor, Occupational Safety and Health Administration, (OSHA), including but not limited to:
    a. Occupational Exposure to Asbestos, Tremolite, Anthophyllite, and Actinolite; Final Rules Title 29, Part 1910, Section 1001 and Part 1926, Section 1101 of the Code of Federal Regulations
    b. Respiratory Protection Title 29, Part 1910, Section 134 of the Code of Federal Regulations
    c. Construction Industry Asbestos Standard Title 29, Part 1926, of the Code of Federal Regulations Construction Industry Lead Standard Title 29, Part 1926, Section 62, of the Code of Federal Regulations
    d. Access to Employee Exposure and Medical Records Title 29, Part 1910, Section 2 of the Code of Federal Regulations
    e. Hazard Communication Title 29, Part 1910, Section 1200 of the Code of Federal Regulations
    f. Specifications for Accident Prevention Signs and Tags Title 29, Part 1910, Section 145 of the Code of Federal Regulations
3. State of Maryland
    a. Control of Asbestos Act, Maryland Code, COMAR Title 26 Subtitle 11, Chapter 21
    b. Asbestos Accreditation of Individuals, and Approval of Training Courses, Maryland Code, COMAR Title 26, Subtitle 11, Chapter 23

1.03 SITE VISIT:

A. Bidders should visit the site to verify existing conditions and establish the amount of ACM to be removed. Arrangements for a site visit must be made through the BOARD'S Environmental Office at (301) 952-6539. NO UNAUTHORIZED VISITS WILL BE PERMITTED.

B. A schematic representation, which indicates the actual work areas, is included for informational purposes, only. The materials listed in the "Scope of Work" portion of this document, are to be removed completely, unless otherwise documented in writing by the BOARD. The BOARD will not accept sample

analysis that the contractor submits relevant to a specific material that is not ACM.

1.04 SUBCONTRACTORS:

A. Full documentation of the firm that will conduct the asbestos work, including certifications and a signed statement affirming they visited the building, must be approved within two(2) business days after the apparent low bidder is notified. This shall include copies of their Maryland License accreditation(s), and references from at least five previous jobs. No contractor substitutions will be permitted, without the BOARD'S consent, after the BOARD reviews and verifies the provided information.

B. The BOARD can reject an Asbestos contractor, if they have demonstrated poor or unsafe performance or poor quality of work from past projects. Any additional costs incurred by the subcontractor or a general contractor, as a result of this action being taken, will not be the responsibility of the BOARD. Asbestos contractors must be pre-approve, with the BOARD's Environmental Office, at least one week prior to the bid due date for this project.

C. In a case where an asbestos contractor has violated any terms or condition of his contract, the BOARD reserves the right to obtain another reputable abatement contractor to complete the remaining work. All associated costs relative to that work shall be borne by the original abatement contractor.

1.05 ASBESTOS REMOVAL PLANS:

A. As soon as possible but not later than 14 calendar days after receipt of a contract award, the successful bidder shall submit a detailed removal plan, for each facility, including shop drawings, prepared and signed by an accredited AHERA Project Designer, for the Board's approval. The drawings shall detail the following items for each work section, as required:

1. Work areas
2. Work entrance and exit points
3. Shower and clean room locations
4. Locations and quantities of negative pressure ventilation equipment
5. Storage locations for supplies and equipment
6. Storage locations for removed materials prior to such materials being transported off site
7. Cleanup and waste disposal plans
8. The locations of any demolition activity the contractor may undertake in order to gain access to remove any ACM
9. Work schedule
10. Number of workers and copies of their qualifications

1.06 NOTIFICATION TO REGULATORY AUTHORITIES:

A. The contractor is responsible for making required notification to the Maryland Air Management Administration, the Environmental Protection Agency and any other regulatory authorities with jurisdiction. Copies of such notification must be provided to the BOARD before work can begin.

B. NOTICES: ENVIRONMENTAL PROTECTION AGENCY

1. Send Written Notification as required by USEPA National Emission Standards for Hazardous Air Pollutants (NESHAPS) Asbestos Regulations (40CFR 61, Subpart M) to the regional Asbestos NESHAPS Contact at least 10 days prior to beginning any work on asbestos-containing materials. Send notification to the following address:

   a. REGION 3: USEPA, Region III 1650 Arch Street Philadelphia, Pennsylvania 19103-2029

2. Notification must be sent to EPA for all demolitions and for renovations involving 160 square feet or 260 linear feet or more.
3. Notification: Include the following information in the notification sent to the NESHAPS Contact:
    a. Name and address of owner or operator.
    b. Description of the facility being demolished or renovated, including the size, age, and prior use of the facility.
    c. Estimate of the approximate amount of friable asbestos material present in the facility in terms of linear feet of pipe, and surface area on other facility components. For facilities in which the amount of friable asbestos materials less than 80 linear meters (260 linear feet) on pipes and less than 15 square meters (160 square feet) on other facility components, explain techniques of estimation.
    d. Location of the facility being demolished or renovated.
    e. Scheduled starting and completion dates of demolition or renovation.
    f. Nature of planned demolition or renovation and method(s) to be used.
    g. Procedures to be used to comply with the requirements of USEPA National Emission Standards for Hazardous Air Pollutants (NESHAPS) Asbestos Regulations (40 CFR 61 Subpart M). Final Rule.
    h. Name and location of the waste disposal site where the friable asbestos waste material will be deposited.
    i. For facilities being demolished under an order of a State or local governmental agency, issued because the facility is structurally unsound and in danger of imminent collapse, the name, title, and authority of the State or local governmental representative who has ordered the demolition.

1.07 STATE AGENCIES:

A. Send written Notification as required by local regulations prior to beginning any work on asbestos-containing materials to:

B. Asbestos Licensing/Enforcement Division MD Department of Environment (MDE) 1800 Washington Boulevard Baltimore, Maryland 21230 1. Notification must be postmarked 10 working days prior to commencement of work.

1.08 LICENSES:

A. Licenses: Maintain current licenses as required by applicable state or local jurisdictions for the removal, transporting, disposal or other regulated activity relative to the work of this contract.

B. Posting and Filing of Regulations: Maintain two (2) copies of applicable federal, state and local regulations above. Post one copy of each at the job site. Keep on file in contractor's office one copy of each.

C. Copies of all notification will be provided to the BOARD before work can begin.

1.09 ALTERNATIVE PROCEDURES:

A. Procedures described in the specifications will be used at all times. If the specified procedures cannot be utilized, the contractor shall provide a written statement to the BOARD’S Environmental Office describing the problems encountered and recommended alternatives. Any alternative procedures must be approved by the BOARD and regulatory authorities before implementation. The BOARD reserves the right to reject any variances or alternative methods not found to be acceptable to the BOARD.

1.10 MONITORING WORK PROGRESS:

A. The BOARD's Environmental Office, Safety Office and/or contracted industrial hygienist will monitor the progress of work. This person(s) shall have the authority to make work-in progress inspections at any time and to stop work if, in their opinion, an immediate health threat exists to the public or the contractor's employees due to improper work methods or noncompliance with the specifications or regulations.

B. In situations where job site performance is unsatisfactory but does not present an immediate health threat to the public or workers, a written warning will be given to the contractor. A deadline will be given to correct the referenced situation. Failure to comply with said written orders could be considered grounds for shutting down a job until said condition has been remedied to the satisfaction of the BOARD.

C. The BOARD'S Environmental Office and/or the contracted industrial hygiene consultant will have final authority over questions of interpretation of regulations and specifications. Whenever a conflict occurs, the most stringent requirement shall be followed.

1.11 PERMISSION TO BEGIN WORK:

A. Prior to asbestos abatement activities (including preparatory work such as containment system fabrication), a pre-job meeting shall be scheduled at which time the contractor shall submit proof satisfactory to the BOARD that all required permits and arrangements for transportation and disposal of waste materials have been made. The Contractor shall also provide a list of all employees who will be working on the project along with submitting AHERA. and Maryland training accreditation for these workers. At the pre-job meeting, the Contractor and the BOARD'S Environmental Office representative will review the specifications and asbestos removal plans. The BOARD'S Environmental Office will respond verbally to any questions by the Contractor. The BOARD will document all verbal authorization via written memoranda.

B. The contractor shall not begin any site work, either actual abatement or preparatory work until he has received verbal permission from the Environmental Office. The BOARD will document all verbal authorizations via written memoranda.

C. After completing preparatory activities for each work area, the contractor must arrange for a site inspection by the BOARD's Environmental Office before authorization to begin actual asbestos removal. During this inspection the contractor shall demonstrate (where applicable) that the containment system, mini enclosures, work entrance way, etc. are properly sealed and all meet the specifications. Additionally, he will be required to prove proper operation of any required negative pressure ventilation equipment. This inspection process shall be repeated as each new work area is established. No asbestos removal can begin until the satisfactory completion of such an inspection.

1.12 AIR SAMPLING BY THE CONTRACTOR AND/OR CONTRACTED INDUSTRIAL HYGIENE CONSULTANT:

A. PERSONAL SAMPLING - The contractor will be responsible for conducting and paying for "personal" air samples during the course of work. Personal air monitoring will be conducted for the maintenance of Time Weighted Average (TWA) fiber counts for types of respiratory protection required. This includes Short Term Excursion (STEL) Level samples of 30 minutes. These samples can be collected by the contracted industrial hygiene consultant.

B. BACKGROUND SAMPLING - The BOARD's hygiene consultant will conduct background air samples for each containment area to establish background fiber levels prior to work commencing along with all daily air tests and personal air sampling. These samples can be collected by the contracted industrial hygiene consultant. The hygiene consultant shall coordinate with the BOARD'S Environmental Office the exact location where these samples will be taken and the time of day when daily samples will be taken. The analysis laboratory shall use methods approved by the Environmental Protection Agency. The samples will be archived in case the BOARD has a need to retrieve them.

C. Results of the air test taken within the work area prior to commencement of work will determine the need for respirator use during construction of containment systems. If these air tests show fiber levels higher than the permissible exposure limit, respirators will be worn during containment fabrication; otherwise respirator use during this phase is optional. “Personal” samples will be taken during containment construction since airborne fiber levels may increase during this work. If the results of the samples taken during this activity show levels higher than the permissible exposure limit, respirators and other protective equipment shall immediately be utilized for the remainder of all containment work.

D. OUTSIDE AMBIENT AIR SAMPLES

1. Air Samples will be collected daily outside but nearby the work area to detect faults in the work area isolation such as:

   a. Contamination of the building outside of the work area with airborne asbestos fibers,

   b. Failure of filtration or rupture in the negative pressure system,

   c. Contamination of the building exterior with airborne asbestos fibers

2. These samples will be collected by the contracted industrial hygiene consultant. If airborne fiber levels in such samples exceed air fiber levels revealed in the “before work” (background) ambient samples or 0.1 fibers per cubic centimeter (fiber/cc), the contractor shall immediately stop work and notify the BOARD’s Environmental Office. If this air sample was taken inside the building and outside of critical barriers around the work area, the contractor shall immediately inspect the critical barriers to ensure their integrity. The affected area shall be isolated from the balance of the building and evacuated if the area is occupied. Critical barriers shall be erected at the next existing structural isolation of the involved space (e.g. wall, pipe, and floor). The project will be reviewed jointly by the contractor and the BOARD’s Environmental Office to determine and correct the cause of the high air sample results. The contractor will clean the outside area and retest before work can be restarted.

1.13 INSIDE AIR SAMPLES

A. The contractor shall maintain an average airborne count in the work area of less than 0.2 fibers/cc. If the fiber counts rise above this figure for any sample taken, the contractor shall revise work procedures (i.e., additional use of amended water or increased negative pressure to lower fiber counts). If these methods do not effectively reduce the average airborne level then the contractor is to stop all work, leave engineering controls/negative air system in operation and notify the BOARD’S Environmental Office. Do not recommence work until authorized by the BOARD’S Environmental Office.

1.14 ANALYTICAL METHODS:

A. The NIOSH 7400 method of phase contrast microscopy will be used by the laboratory in analyzing filters used to collect air samples before and during abatement. Transmission Electron Microscopy shall be performed on final air sampling.

1.15 SAMPLE VOLUMES:

A. General: The number and volume of air samples taken by the Industrial Hygiene Consultant will be in accordance with the following schedule. Sample volumes given may vary depending upon the analytical method used.

1.16 SCHEDULE OF AIR SAMPLES:

A. Before Start of Work: Base Line: Pre-Tests are taken to establish background levels of airborne fibers to determine respiratory protection required during preparation of the work area. If any of the Pre-Tests or the air samples taken during preparation are >0.01 fibers per cubic centimeter (f/cc) the workers shall wear respiratory protection. The type of respirator worn shall be determined by the standards set in OSHA Regulations 29CFR 1910.1001. The Industrial Hygiene Consultant will secure the following Air

Samples:

1. SCHEDULE BASE LINE : Before Start of Work Pre-Test).

Project Size	IWA	OWA	Blank	Analysis
>5,000 SF	5	5	2	PCM
>500 LF	5	5	2	PCM
<5,000 SF	5	5	2	PCM
<500 LF	5	5	2	PCM

1) **ACM -** Asbestos Containing Material
2) **TEM** - Transmission Electron Microscopy
3) **IWA** - Inside Work Area
4) **OWA** - Outside Work Area
5) **PCM** - Phase Contrast Microscopy, NIOSH 7400 Method

2. SCHEDULE OF DAILY AIR SAMPLES : During Work

Project Size	IWA	OWA	Blank	Analysis
>5,000 SF	4	4	2	PCM
>500 LF	4	4	2	PCM
<5,000 SF	2	2	2	PCM
<500 LF	2	2	2	PCM

1) **ACM -** Asbestos Containing Material
2) **TEM** - Transmission Electron Microscopy
3) **IWA** - Inside Work Area
4) **OWA** - Outside Work Area
5) **PCM** - Phase Contrast Microscopy, NIOSH 7400 Method

1.17 LABORATORY TESTING:

A. The services of a testing laboratory will be employed by the Industrial Hygiene Consultant to perform laboratory analysis of the air samples. A microscope and technician will be setup at the job site (where project conditions permit), so that verbal reports on air samples can be obtained immediately.

B. The services of a testing laboratory will be employed by the Contractor to perform laboratory analysis of the OSHA air samples.

C. A complete record, certified by the testing laboratory, of all air monitoring tests and results will be furnished to the BOARD'S Environmental Office.

D. Verbal Reports: of all air monitoring tests will be communicated at the job site by the Industrial Hygiene Consultant, to the Contractor on a daily basis. Air sample results shall be posted in a central location on a daily basis.

E. Exposure monitoring of the work place for employees safety will be performed in accordance with Occupational Safety and Health Administration (OSHA) Asbestos Regulations for the Construction Industry (20 CFR 1926.1101).

F. Verbal results for all air samples shall be supplied to the BOARD within 24 hours, with written results maintained at the work site.

1.18 DAMAGE TO THE BUILDING:

A. Care shall be taken by the contractor not to damage finishes, wiring, piping or other building systems or equipment. Any such damage shall be corrected per all relative codes and regulations at the contractor's expense.

1.19 ASBESTOS WORKER ACCESS:

A. All work entry is to be made through the nearest exterior door. This location will be given to the Contractor at the pre-construction meeting.

B. Limited parking is available in the school's parking lot. Vehicles must be parked in parking spaces. No parking will be permitted in fire lanes, loading zones, reserved parking spaces, grass, etc. A clear lane must be kept at all times for emergency vehicles, deliveries, and other school traffic.

C. The Contractor shall supply protective equipment, including a respirator and disposable suit to the school Custodian in the event he needs to enter the work area during asbestos removal. D. Smoking is not permitted in this facility or on the property.

1.20 ASBESTOS WORK SCHEDULE:

A. Preliminary asbestos removal work cannot begin until the BOARD issues a written notice to the General Contractor. All asbestos abatement activities, relevant to the ACM found in the actual work area, must be completed within Fourteen (14) calendar days.

B. The Contractor is responsible for paying the wages of the school system personnel if the work is conducted during times when the facility is not staffed.

C. The general Contractor shall limit any other work activities that may inhibit the progress of the asbestos removal work.

D. The BOARD reserves the right to require that all activities involving asbestos work, be conducted during the hours when the school is normally occupied. The BOARD will pay no additional cost, if this stipulation is invoked.

1.21 DISPOSAL OF ASBESTOS:

A. The contractor is free to utilize any landfill approved to accept friable asbestos waste. The contractor shall submit with their bid response, the name and address of the facility he proposes to use.

B. Transportation of asbestos waste must comply with all Federal, State and County Regulations.

C. Copies of all dump receipts; transportation manifests and other documentation of legal disposal shall be supplied to the BOARD'S Environmental Office as disposal occurs. No payment will be made without such documentation of proper disposal.

D. All bagged asbestos debris must be removed from the work area on a daily basis.

E. Bagged debris may be stored on the premises while awaiting transport to the dumpsite. Storage shall be within a locked, closed container, such as a dumpster equipped with a lid or top. This container shall be located as directed by the BOARD'S Environmental Office.

1.22 EQUIPMENT:

A. The contractor will have, as needed, a sufficient quantity of scaffolds, ladders, lifts and hand tools. Under no circumstances will the contractor be allowed to use equipment owned by the BOARD.

1.23 ASBESTOS CONTAINING MATERIAL (ACM) REMOVAL PROCEDURES

A. Asbestos Containing material removal shall be conducted in a regulated enclosure, including hygiene facilities, with negative pressure ventilation units equipped to provide a minimum one work place air change every fifteen (15) minutes and a negative pressure differential inside the work area equal to, or greater than .02 inches of water column.

B. The product name and Material Safety Data Sheet (MSDS) for all materials must be supplied at the pre-job meeting for the BOARD'S Environmental Office approval. No material change will be permitted without the BOARD'S Environmental Office approval.

C. Removal is not complete until all surfaces are smooth to the extent that a sample cannot be obtained. Patched areas will have to be cleaned such that a sample cannot be obtained by scratching away the material.

D. All surfaces (walls, pipes, floors, etc.) shall be free of any residue. The contractor shall take all precautions to limit the spread of odors outside the area of work.

E. The BOARD reserves the right to review and reject unsuitable work practices at its sole discretion.

F. Materials, not identified for removal in these specifications that are damaged by the contractor, will be repaired and/or replaced and the associated cost deducted from the contractor's retention.

G. Other portions of this facility may be occupied and/or used while the asbestos work is being done. The contractor shall take measures to keep the construction related dust to a minimum. The contractor shall also take measures to prevent his activities from creating a disruption to building and instructional activities. The BOARD can require the contractor to work evenings if their operation causes disruptions to the daytime building and instructional activities.

1.24 CLEARANCE TESTING

A. Initial final clearance air testing will be conducted by the company engaged by the BOARD. In the event the initial test shows the average concentration of asbestos of five (5) air samples collected within the containment area are greater than 70 structures per square millimeter 70s/mm2, the contractor is responsible for all costs associated with the second and subsequent final air clearance tests in the affected "work area" from the contractor's final retention. See item XIX.G below for additional information.

B. Each work area will be treated separately for final clearance air testing. The testing will take place as soon as feasible once abatement work is finished.

C. The contractor shall notify the BOARD's representative at least 48 hours in advance of requesting a final air sampling, in each area. Following the satisfactory completion of a visual inspection by BOARD Personnel, the BOARD will arrange for an air-monitoring professional to aggressively sample the air for airborne asbestos fiber concentrations.

D. Final Clearance Sampling-Transmission Electron Analysis (TEM) shall be used to analyze all final clearance air samples per 40 CFR Part, Appendix A to Subpart E.

1. All clearance Air Samples will be taken using aggressive sampling techniques as follows:

a. Sampling shall not begin until 1 hour after the area is dry with no visible water or condensation remaining (a minimum of 4 hours following encapsulation).

b. Samplers shall be placed at random around the work area. If the work area contains the number of rooms equivalent to the number of required samples based on floor area, a sampler shall be placed in each room. When the number of rooms is greater than the required number of samples a representative sample of rooms shall be selected.

c. The representative samplers placed outside the work area but within the building shall be located to avoid any air that might escape through the isolation barriers and shall be approximately 50 feet from the entrance to the work area, and 25 feet from the isolation barriers.

d. In each homogeneous work area after completion of all cleaning work, a minimum of 13 samples will be taken and analyzed as follows:

Location Sampled	Number of	Filter Media	Detection	Minimum	Rate (LPM)

	Samples		Limits Structures/MM2	Volume	
Work Area	5	MCE	70	1200	6-9.9
Outside Work Area	5	MCE	70	1200	6-9.9
Field Blank	2	MCE	70	1200	6-9.9
Sealed Blank	1	MCE	70	1200	6-9.9

1) **Release Criteria:** Decontamination of the work site is complete if the concentration of all samples is (less than) <70 s/mm^2.

E. Final Clearance Sampling for the soil in each work area shall be conducted by Polarized Light Microscopy (PLM) bulk sampling. Nine (9) bulk sampling shall be conducted in a statically random manner of each work area. Each bulk sample shall be less than one percentage (< 1%).

F. The BOARD reserves the right to require that the work area be re-cleaned, at no additional cost, even if the average concentration of asbestos of five air samples collected in the containment area is less than 70s/mm2, and the result of any one (1) sample collected within the work area yields a result of 80s/mm2 or above.

G. The enclosure shall remain intact until final clearance has been obtained and no additional cleaning as specified in Item XIX.G is required. Verbal results will be given to the contractor as soon as the BOARD is given the results; this will be followed up in writing when the results become available.

1.25 ASBESTOS SUBMITTALS:

A. The Contractor shall, submit within two (2) working days, after the apparent low bidder is notified, a qualification statement. This statement will include:

1. Owners of the asbestos removal firm, addresses and telephone numbers.
2. A list of five (5) comparable previous asbestos jobs. The list will include 3 names, addresses, telephone numbers and dates of the jobs
3. Asbestos removal firm’s Maryland license to remove or encapsulate asbestos.
4. A statement that the contractor has ample equipment and personnel to perform the work within the time specified
5. Copies of valid Maryland certificates of all asbestos workers and supervisors who will be performing abatement activities
6. The name, addressed phone number of the disposal facility.
7. The name, addresses and phone number of the independent laboratory that the contractor will employ to analyze air samples

END OF SECTION

SECTION 02 8400
POLYCHLORINATE BIPHENYL (PCB) REMEDIATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish labor, materials, services, and equipment necessary for complete removal and disposal of the following demolition debris in accordance with federal, state, and local regulations:

1. PCB-containing electrical equipment, including transformers, capacitors, and switches.
2. PCB- and DEHP-containing lighting ballasts.
3. Mercury-containing lamps and tubes, including fluorescent lamps, high intensity discharge (HID), arc lamps, ultra-violet, high pressure sodium, mercury vapor, ignitron tubes, neon, and incandescent.

B. Perform PCB removal and disposal work in accordance with 40 CFR 761 and the requirements specified herein.

1.02 RELATED REQUIREMENTS

A. Section 01 7000 - Execution and Closeout Requirements: Other selective demolition procedures.

B. Section 01 7419 - Construction Waste Management and Disposal: Disposal of normal demolition debris.

C. Section 02 4100 - Demolition: Demolition of entire buildings.

D. Section 26 0505 - Selective Demolition for Electrical.

1.03 DEFINITIONS

A. Toxic Substances: PCBs, mercury, and other substances regulated under the U.S. Federal Toxic Substances Control Act (TSCA); substances covered by this specification are identified under SECTION INCLUDES.

B. Leak: Leak or leaking means any instance of a toxic substance present on any portion of the external surface of an item of equipment or container.

C. PCBs: PCBs as used in this specification shall mean the same as PCBs, PCB Article, PCB Article Container, PCB Container, PCB Equipment, PCB Item, PCB Transformer, PCB-Contaminated Electrical Equipment, as defined in 40 CFR 761, Section 3, Definitions.

D. Universal Waste: Any of the following hazardous wastes that are managed under the universal waste requirements of 40 CFR 273:

1. Batteries as described in Sec. 273.2 of that chapter.
2. Thermostats as described in Sec. 273.4 of that chapter.
3. Lamps as described in Sec. 273.5 of that chapter.

1.04 REFERENCE STANDARDS

A. 29 CFR 1910.132-138 - Personal Protective Equipment current edition.

B. 29 CFR 1910.145 - Accident Prevention Signs and Tags current edition.

C. 29 CFR 1910.1000 - Air Contaminants current edition.

D. 40 CFR 273 - Standards For Universal Waste Management current edition.

E. 40 CFR 761 - Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution In Commerce, And Use Prohibitions current edition.

F. 49 CFR 178 - Specifications for Packaging current edition.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures, except that all submittals are to be made to Owner, not to Architect.

B. Qualifications of Certified Industrial Hygienist: Submit name, address, and telephone number and documentation of certification, including certification number and date of certification or recertification.

C. Toxic Substances Removal Work Plan.

D. Disposal Plan.

E. Worker Training Certification: Submit certificates, prior to the start of work but after the main abatement submittals, signed and dated by the Certified Industrial Hygienist and by each employee stating that the employee has received training; organize by individual worker not by type of certificates.

F. Spill notification and documentation:

1. Certification of Decontamination for PCB Spill.

2. Post-cleanup sampling data, if required.

G. Transporter and disposal documentation.

1.06 QUALITY ASSURANCE

A. Notification: Notify Owner 20 days prior to the start of toxic substance removal work.

B. Reference Documents: At all times maintain one copy each of 29 CFR 1910.1000, 40 CFR 761, and Contractor work practices for removal, storage and disposal of toxic substances, at field office and one copy each in view at project site.

C. Certified Industrial Hygienist (CIH): Obtain services of an industrial hygienist certified by American Board of Industrial Hygiene to review and approve Toxic Substances Removal Plan, including determination of the need for personnel protective equipment (PPE) in performing toxic substance removal work, and to certify training.

D. Training: Instruct employees on dangers of exposure to toxic substances present and on respirator use, decontamination, and applicable regulations.

E. Surveillance Personnel: Surveillance personnel may enter Control Areas for brief periods of time provided they wear disposable polyethylene gloves and disposal polyethylene foot covers, as a minimum. Additional protective equipment may be required if respiratory hazard is involved or if skin contact with PCB is involved.

F. Toxic Substances Removal Work Plan: Submit a detailed job-specific plan of the work procedures to be used in the removal and containment of toxic substance-containing materials, not to be combined with other hazardous abatement plans.

1. Select removal procedures to minimize contamination of work areas with toxic substances or contaminated debris or waste.

2. Include a sketch showing the location, size, and details of Control Areas.

3. Include location and details of decontamination rooms, change rooms, shower facilities and mechanical ventilation system.

4. Include eating, drinking, smoking and restroom procedures, interface of trades, sequencing of related work, Disposal Plan, respirators, protective equipment, and a detailed description of the method of containment of the operation to ensure that toxic substances are not spread or carried outside of the control area unless properly containerized or controlled.

5. Obtain approval of plan prior to the start of removal work.

G. Disposal Plan: Within 45 calendar days after award of contract submit a Disposal Plan that complies with applicable requirements of federal, state, and local waste regulations.

1. Do not proceed without Owner 's approval of plan.
2. Do not proceed without Architect 's approval of plan.
3. Include in Plan:
    a. Identification of wastes associated with the work.
    b. Estimated quantities of wastes to be generated and disposed of.
    c. Names and qualifications of each contractor that will be transporting, storing, treating, and disposing of the wastes.
    d. Disposal facility location and 24-hour point of contact; furnish two copies of facility's EPA waste permit applications and EPA Identification numbers.
    e. Names and qualifications (experience and training) of personnel who will be working on-site with toxic substances.
    f. List of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment.
    g. Spill prevention, containment, and cleanup contingency measures to be implemented.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Special Clothing (PPE): Work clothes shall consist of personal protective equipment (PPE) as required by 29 CFR 1910.132-138; including, but not limited to, the following:

1. Disposable coveralls.
2. Gloves (Disposable rubber gloves may be worn under these).
3. Disposable foot covers (polyethylene).
4. Chemical safety goggles.
5. Half mask cartridge respirator.

B. Special Clothing for Owner 's Personnel Required to Enter Control Areas: Provide PPE same as specified for workers.

C. PCB Spill Kit: Include the following items, in at least the quantity indicated:

1. Disposable Gloves (Polyethylene): 6 Pairs.
2. Gloves With A High Degree Of Impermeability To PCB: 6 Pairs
3. Disposable Coveralls With Permeation Resistance To PCB: 4 Each.
4. Chemical Safety Goggles: 2 Each.
5. Disposable Foot Covers (Polyethylene): 6 Pairs.
6. PCB Caution Sign: "PCB Spill--Authorized Personnel Only": 2 Each.
7. Banner Guard Or Equivalent Banner Material: 100 feet (30 m).
8. Absorbent Material.
9. Blue Polyethylene Waste Bags: 5 Bags.

10. Cloth Backed Tape: 5 Each.
11. Area Access Logs, Blank: 1 Roll.
12. Brattice Cloth 6 by 6 feet (2 by 2 m): 10 Each.
13. Rags: 1 Piece.
14. Ball Point Pens: 20 Each.
15. Herculite, 4 by 4 feet (1.5 by 1.5 m): 2 Each.
16. Herculite, 8 by 8 feet (3 by 3 m): 1 Each.
17. Blank Metal Signs And Grease Pencils.
18. Waste Containers: 55 gallon (208 Liters): 2 Each.
19. Drum (May Be Used As Container For Kit): 1 Each.

D. PCB Caution Labels: Comply with 40 CFR 761, Subpart C.
   1. Affix labels to PCB waste containers and PCB-contaminated items not stored in containers.
   2. Provide label with sufficient print size to be clearly legible, with bold print on contrasting background, displaying the following: "CAUTION: Contains PCBs (Polychlorinated Biphenyls)."

E. Caution Signs: Comply with 29 CFR 1910.145.
   1. Provide signs at approaches to Control Areas.
   2. Locate signs at such a distance that personnel may read the sign and take the necessary precautions before entering the control area.

F. Storage Containers for PCBs: Comply with 49 CFR 178.
   1. Liquid PCBs: Department of Transportation (DOT) Specification 17E containers.
   2. Non-Liquid PCB Mixtures, Articles, and Equipment: DOT Specification 5, 5B, or 17C containers with removable heads.

G. Storage Containers for Mercury-Containing Lamps: Appropriate DOT containers (original transport boxes or equivalent).

PART 3 EXECUTION

3.01 PREPARATION

A. Control Area: Isolate Control Area by physical boundaries to prevent unauthorized entry of personnel; do not permit food, drink, or smoking materials in areas where toxic substances are handled or stored.

3.02 WORK PROCEDURE - PCBS

A. Permissible Exposure Limits (PEL): PEL for PCBs is 3.1 E-08 pounds per cubic foot (0.5 mg/cu m) on an 8-hour time weighted average basis.

B. Work Operations: Ensure that work operations and processes involving PCB or PCB-contaminated materials are conducted in accordance with 40 CFR 761 and the applicable requirements of this section, including but not limited to:
   1. Obtaining advance approval of PCB storage sites.
   2. Notifying Owner prior to commencing the operation.
   3. Reporting leaks and spills to Owner .
   4. Cleaning up spills.

5. Maintaining access log of employees working in Control Area and providing copy to Owner upon completion of the operation.
6. Inspecting PCB and PCB-contaminated items and waste containers for leaks and forwarding copies of inspection reports to Owner .
7. Maintaining the specified spill kit.
8. Maintaining inspection, inventory and spill records.

C. Perform PCB removal as described in PCB Removal Work Plan; handle PCBs so that no skin contact occurs.

D. Personnel Protection: Require workers to wear and use PPE, as recommended by the Industrial Hygienist, upon entering PCB control area. If PPE is not required by the CIH, so state in PCB Removal Work Plan.

E. Footwear: Keep work footwear inside work area until completion of removal operations.

F. Hazards:

1. Do not expose PCBs to open flames or other high temperature sources since toxic decomposition by-products may be produced.
2. Do not heat or handle PCBs to temperatures of 135 degrees F (55 degrees C) or higher without Owner 's concurrence.

G. Package, mark, transport, and dispose of PCBs as required by regulations.

H. Control Area: Allow only personnel certified as having received specified training into the control area.

I. No Smoking: Smoking is not permitted within 50 feet (15 m) of control area; provide "No Smoking" signs as directed by Owner .

J. Confined Spaces: Wherever feasible, do not carry out PCB handling operations in confined spaces having limited means of egress and inadequate cross ventilation.

K. Exhaust Ventilation: If used, discharge exhaust ventilation for PCB operations to outside and away from personnel.

L. Solvent Cleaning: Clean contaminated tools, containers, etc., after use by rinsing three times with appropriate solvent or by wiping down three times with solvent wetted rag; suggested solvents are Stoddard solvent and hexane.

M. Drip Pans: Place drip pans under portable PCB transformers and rectifiers in use or stored for use; provide pans with containment volume of at least one and one-half times internal volume of PCBs that would drain into pan.

N. Evacuation Procedures: Establish written procedures for evacuation of injured workers; do not delay aid for a seriously injured worker for reasons of decontamination.

3.03 PCB-CONTAINING EQUIPMENT EXCEPT BALLASTS

A. Draining of Liquid PCB: Drain equipment items of free flowing liquid prior to transportation.

1. Place the drained liquids in specified containers, filled with not more than 50 gallons (190 liters) of oil.
2. Do not mix different concentrations in the same container.
3. Containers must have a 2 inch (50 mm) ullage space from the top of the container.
4. After draining add absorbent material to absorb oil residue remaining.

B. If equipment cannot be drained, place it in storage container of the type specified.

C. Markings: Apply specified PCB Caution Labels to containers and drained PCB-contaminated electrical equipment.

1. Apply date drained to transformer using stencil or grease pencil.
2. Containers: Stencil on the following:
    a. PCB content in parts per million (ppm).
    b. Date container filled.
    c. Serial number of transformer liquid came from.

3.04 BALLASTS

A. As ballasts are removed from lighting fixtures, inspect label on ballast.

1. Ballasts Without "No PCB" Label: Assume to contain PCBs; containerize and dispose of as specified.
2. Ballasts With "No PCB" Label: If there are less than 1600 total to be removed from project, dispose of them as normal demolition debris.

B. More Than 1600 "No PCB" Labeled Ballasts: Determine whether the "No PCB" labeled ballasts contain diethylhexyl phthalate (DEHP) either by testing or by checking with ballast manufacturer indicated on the label.

1. Submit testing results and/or written confirmation from manufacturer to Owner .
2. If the ballasts do not contain DEHP, dispose of them as normal demolition debris.
3. If they do contain DEHP, dispose of them as as specified for PCBs.
4. As basis of contract assume ballasts with "No PCB" labels do not contain DEHP.
5. If 1600 or more DEHP ballasts are disposed of in a 24 hour period, notify the National Response Team at 800-424-8802.

3.05 MERCURY-CONTAINING LIGHTING LAMPS

A. Lighting Lamps: Remove lighting tubes/lamps from lighting fixtures and carefully place, unbroken, into containers.

1. In the event a lighting tube/lamp breaks, sweep up pieces and contents and place waste in double plastic taped bags and dispose of as Universal Waste as specified in 40 CFR 273.

B. Deliver unbroken, boxed, lamps to Owner at location directed.

3.06 PCB SPILL CLEANUP REQUIREMENTS

A. Immediately report to Owner all PCB spills on the ground or in the water, PCB spills in drip pans, and PCB leaks.

B. Control Area: Rope off area around edges of PCB leaks and spills and post "PCB Spill Authorized Personnel Only" caution sign. Immediately transfer leaking items to drip pan or other container.

C. Cleanup: Comply with 40 CFR 761, Subpart G.

1. Initiate cleanup of spills as soon as possible, but no later than 48 hours of its discovery.
2. Require personnel to wear specified PPE, unless determined not required by CIH.
3. If misting, elevated temperatures, or open flames are present, or if spill is situated in a confined space, notify Owner .
4. Mop up liquid with rags or other conventional absorbent.

5. Treat spent absorbent as solid PCB waste.

D. Records and Certification: Document cleanup with records of decontamination in accordance with 40 CFR 761, Section 125, Requirements for PCB Spill Cleanup; provide certification of decontamination.

E. Sampling: Perform post cleanup sampling as required by 40 CFR 761, Section 130, Sampling Requirements.

F. Do not remove boundaries of PCB control area until site is determined satisfactorily clean by Owner .

3.07 TEMPORARY STORAGE PRIOR TO DISPOSAL

A. Storage Site: Obtain Owner 's approval in advance of areas, spaces, rooms, and buildings used to store toxic substances prior to disposal off-site; storage sites must comply with the following criteria without exception:

1. Adequate roof and walls to prevent rainwater from reaching stored toxic substances.
2. Adequate floor that has continuous curbing with minimum 6 inch (50 mm) high curb, with containment volume equal to at least two times internal volume of largest toxic substance article or container stored therein or 25 percent of total internal volume of all toxic substance containing equipment or containers stored therein, whichever is greater.
3. No drain valves, floor drains, expansion joints, sewer lines, or other openings that would permit liquids to flow from curbed area.
4. Floors and curbing constructed of continuous smooth and impervious materials, such as Portland cement, concrete, or steel, to prevent or minimize penetrations of toxic substances.
5. Not located at a site that is below the 100-year flood water elevation.
6. Posted with specified Caution Sign.

B. Store PCBs, PCB articles, and PCB-contaminated items in specified containers.

1. Label waste containers with the following:
   a. "Solid (or Liquid) Waste Polychlorinated Biphenyls."
   b. Specified PCB Caution Label.
   c. Date item was placed in storage and name of generator.
2. Label PCB articles and PCB-contaminated items with the following:
   a. Specified PCB Caution Label.
   b. Date item was placed in storage and name of generator.

C. Label mercury-containing lamp waste in accordance with 40 CFR 273. Affix labels to all lighting waste containers.

3.08 CLEANING

A. Clean up and containerize wastes daily.

B. Maintain surfaces of Control Areas free of accumulations of toxic substances. Restrict spread of dust and debris; keep waste from being distributed over work area.

C. Do not remove Control Area boundaries or warning signs prior to Owner 's approval.

D. Reclean areas showing residual toxic substances.

3.09 DISPOSAL BY CONTRACTOR

A. Comply with disposal requirements and procedures specified in 40 CFR 761 and [_____]; deliver toxic substance waste to a disposal facility having required permits.
   1. Do not accept toxic substance waste unless it is accompanied by a manifest signed by Owner .
   2. Before transporting toxic substance waste, sign and date manifest acknowledging acceptance of the waste from Owner .
   3. Return a signed copy to Owner before leaving project site.
   4. Ensure that manifest accompanies waste at all times.
   5. Submit transporter certification of notification to EPA of their toxic substance waste activities.

B. Certificate of Disposal: Submit to Owner within 30 days of date that disposal of waste identified on manifest was completed; include on the certificate:
   1. The identity of disposal facility, by name, address, and EPA identification number.
   2. The identity of waste affected by Certificate of Disposal including reference to manifest number for the shipment.
   3. Statement certifying the fact of disposal of the identified waste, including date(s) of disposal, and identifying disposal process used.
   4. Certification as defined in 40 CFR 761, Section 3.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Horizontal slat louver blinds.

B. Operating hardware.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

B. Section 10 7113 - Exterior Sun Control Devices: Exterior horizontal louver blinds.

C. Section 12 2116 - Vertical Louver Blinds.

1.03 PRICE AND PAYMENT PROCEDURES

A. Allowances: See Section 01 2100 - Allowances, for cash allowances affecting this section.

1.04 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. WCMA A100.1 - Safety of Window Covering Products 2018.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the placement of concealed blocking to support blinds. See Section 06 1000.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating physical and dimensional characteristics.

C. Shop Drawings: Indicate opening sizes, tolerances required, method of attachment, clearances, and operation.

D. Samples: Submit two samples illustrating slat materials and finish, cord type and color.

E. Manufacturer's Installation Instructions: Indicate special procedures.

F. Maintenance Materials: Furnish the following for Owner 's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Blind Assemblies: One of each size.
3. Extra Slats: 20 of each type and size.
4. Extra Lift Cords, Control Cords, and Wands: One of each type.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Horizontal Louver Blinds:

1. Substitutions: See Section 01 6000 - Product Requirements.

B. Horizontal Louver Blinds With Side Guides:

1. Basis of Design: Draper, Inc; Venetian Blinds by Warema; www.draperinc.com/#sle.
2. Other Acceptable Manufacturers:
3. Substitutions: See Section 01 6000 - Product Requirements.

C. Source Limitations: Furnish blinds and associated controls produced by a single manufacturer and obtained from a single supplier.

2.02 BLINDS

A. Description: Horizontal slat louvers hung from full-width headrail with full-width bottom rail.

B. Manual Operation: Control of raising and lowering by cord with full range locking; blade angle adjustable by control wand.

C. Metal Slats: Spring tempered pre-finished aluminum; square slat corners, with manufacturing burrs removed.

1. Width: 2 inch (50 mm).
2. Color: As selected by Architect.

D. Wood Slats: square slat corners.

1. Width: 2 inch (50 mm).
2. Pre-finished, color as selected by Architect.

E. Slat Support: Woven polypropylene cord, ladder configuration.

F. Head Rail: Pre-finished, formed aluminum box, with end caps; internally fitted with hardware, pulleys, and bearings for operation; same depth as width of slats.

1. Color: Same as slats.

G. Bottom Rail: Pre-finished, formed steel; with end caps.

1. Color: Same as headrail.

H. Lift Cord: Braided nylon; continuous loop; complying with WCMA A100.1.

1. Free end weighted.
2. Color: As selected by Architect.

I. Control Wand: Extruded hollow plastic; hexagonal shape.

1. Non-removable type.
2. Length of window opening height less 3 inch (76 mm).
3. Color: Clear.

J. Headrail Attachment: Wall brackets.

K. Accessory Hardware: Type recommended by blind manufacturer.

2.03 BLINDS WITH SIDE GUIDES

A. Description: Horizontal slat louvers hung from full-width headrail with full-width bottom rail and side guides for slat stability.

B. Manual Operation: Control of raising, lowering, and tilting blades by crank operator. Gear box concealed in headrail; fixed handle.

C. Headrail: Extruded aluminum, size according to length of drop of blinds.

D. Headrail Box: Custom fabricated sheet aluminum box to protect blinds in raised position. Size as required to cover stack of retracted blinds.

E. Bottom Rail: Extruded aluminum with plastic end caps, size according to width of slat.

F. Metal Slats: Pre-finished aluminum; square slat corners, with manufacturing burrs removed.

1. Width: 2 inch (50 mm).

G. Slat Support: Heavy-duty, tear-resistant terylene yarn, ladder configuration.

H. Side Guides:

1. Extruded aluminum side channels with plastic inserts.

I. Headrail Attachment: Direct-mounted.

J. Finish/Color:

1. Other exposed aluminum components: Color to match slats.

2.04 FABRICATION

A. Determine sizes by field measurement.

B. At openings requiring multiple blind units, provide separate blind assemblies with space as specified by architect between blinds, located at window mullion centers.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings are ready to receive the work.

B. Ensure structural blocking and supports are correctly placed. See Section 06 1000.

3.02 INSTALLATION

A. Install blinds in accordance with manufacturer's instructions.

B. Secure in place with flush countersunk fasteners.

3.03 TOLERANCES

A. Maximum Variation of Gap at Window Opening Perimeter: 1/4 inch (6 mm).

B. Maximum Offset From Level: 1/8 inch (3 mm).

3.04 ADJUSTING

A. Adjust blinds for smooth operation.

3.05 CLEANING

A. Clean blind surfaces just prior to occupancy.

B. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roll-up mats.

B. Recessed mat frames.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating properties of walk-off surface, component dimensions, recessed frame characteristics and profiles, and finishes.

C. Shop Drawings: Indicate dimensions, details for recessed frame, and divisions between mat sections.

1. For recessed frames located within a dimensionally restricted area, show dimensions of space within which the frame will be installed.

D. Samples for Initial Selection: For each type of product indicated.

E. LEED Submittals:

1. Credit MR 4: Product Data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.

a. Contributions to this Credit include recycled content of aluminum.

F. Maintenance Data: Include cleaning instructions and stain removal procedures.

1.03 QUALITY ASSURANCE

A. Source Limitations: Obtain floor mats and frames through one source from a single manufacturer.

B. Accessibility Requirements: Provide installed floor mats that comply with most stringent requirements of Section 4.5 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" and Sections 302 and 303 in ICC A117.1.

1.04 PROJECT CONDITIONS

A. Field Measurements: Indicate measurements on Shop Drawings.

1.05 COORDINATION

A. Coordinate size and location of recesses in concrete with installation of finish floors to receive floor mats and frames.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Floor Mats:

1. American Floor Products Company, Inc: www.afco-usa.com.

2. C. Musson Rubber Co: www.mussonrubber.com.

3. Pawling Corporation: www.pawling.com.

4. C/S Group .

2.02 MATS

A. Roll-Up, Aluminum-Rail Hinged Mats: Extruded-aluminum tread rails 1-1/2 inches wide by 3/8 inches thick, sitting on continuous vinyl cushions.

1. Tread Inserts: 32-oz./sq. yd. weight, fusion-bonded solution-dyed polypropylene carpet.
2. Rail Color: Clear.
3. Hinges: Aluminum.
4. Mat Size: As indicated.
5. Products:
    a. American Floor Products Company, Inc.; Stratoflex III Foot Grid System.
    b. C/S Group; Product Pedimat.
    c. Musson, R. C. Rubber Co.; Product EM-800.
    d. Pawling Corporation; Architectural Products Division; Product EM-800 Rol-Dek.

B. Recessed Frame:

1. Extruded Aluminum: ASTM B 221, Alloy 6061-T6 or Alloy 6063-T5, T6, or T52.
2. Color: Clear anodized.

2.03 CONCRETE FILL AND GROUT MATERIALS

A. Provide concrete grout and fill equivalent in strength to cast-in-place concrete slabs for recessed mats and frames. Use aggregate no larger than one-third fill thickness.

2.04 FABRICATION

A. Construct recessed mat frames square, tight joints at corners, rigid. Coat surfaces with protective coating where in contact with cementitious materials.

B. Fabricate mats in single unit sizes; fabricate multiple mats where indicated. Do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and floor conditions for compliance with requirements for location, sizes, minimum recess depth, and other conditions affecting installation of floor mats and frames.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Mats: Verify size of floor recess before fabricating mats.

B. Vacuum clean floor.

3.03 INSTALLATION

A. Install frames to achieve flush plane with finished floor surface and comply with manufacturer's written instructions.

B. Coordinate top of mat surfaces with bottom of doors that swing across mats to provide clearance between door and mat.

C. Install walk-off surface in floor recess flush with finish floor after cleaning of finish flooring.

1. Install necessary shims, spacers, and anchorages for proper location and secure attachment of frames.
2. Install grout and fill around frames and, if required to set mat tops at proper elevations, in recesses under mats. Finish grout and fill smooth and level.

3.04 PROTECTION

A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

END OF SECTION

SECTION 03 0100
MAINTENANCE OF CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cleaning of existing concrete surfaces.

B. Repair of exposed structural, shrinkage, and settlement cracks.

C. Resurfacing of concrete surfaces having spalled areas and other damage.

D. Repair of deteriorated concrete.

E. Repair of internal concrete reinforcement.

F. Scope of Work: As indicated on drawings.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.

1.03 PRICE AND PAYMENT PROCEDURES

A. See Section 01 2200 - Unit Prices, for additional unit price requirements.

B. Repair Surface: By the square foot (meter). Includes surface preparation, repair, finishing.

C. Preparation for Resurfacing: By the square yard (meter). Includes surface preparation, cleaning.

1.04 REFERENCE STANDARDS

A. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2018, with Editorial Revision (2018).

B. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement 2016.

C. ASTM A996/A996M - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement 2016.

D. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2018.

E. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2016, with Editorial Revision (2016).

F. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens 2018.

G. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens) 2016a.

H. ASTM C150/C150M - Standard Specification for Portland Cement 2018.

I. ASTM C348 - Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars 2014.

J. ASTM C404 - Standard Specification for Aggregates for Masonry Grout 2011.

K. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete 2015.

L. ASTM C928/C928M - Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Material for Concrete Repairs 2013.

M. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete 2013.

N. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel 2011.

O. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair 2013.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Scheduling: Perform blast cleaning only between the hours of 7 am to 10 pm.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate product standards, physical and chemical characteristics, technical specifications, limitations, maintenance instructions, and general recommendations regarding each material.

C. Designer's Qualification Statement.

D. Manufacturer's Qualification Statement.

E. Installer's Qualification Statement.

F. Project Record Documents: Accurately record actual locations of structural reinforcement repairs and type of repair.

1.07 QUALITY ASSURANCE

A. Designer Qualifications: Design reinforcement splices under direct supervision of a Professional Structural Engineer experienced in design of this type of work and licensed in Maryland.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with minimum of 3 years of documented experience.

1.08 MOCK-UP(S)

A. Test each type of maintenance procedure required on each type of existing construction, to determine the most appropriate procedures to use and as a record of expected results.

B. Crack Injection: Prepare one sample of each type of injection.

C. Horizontal Surface Repair: Total of 10 foot (3 m) square area, demonstrating each type of repair.

D. Vertical Surface Repair: Total of 10 foot (3 m) square area, demonstrating each type of repair.

E. Where color or texture matching is required, first prepare a small size sample on cementitious board.

F. Locate mock-up(s) where directed.

G. Re-work mock-up(s) until satisfactory to Architect.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturers' instructions for storage, shelf life limitations, and handling of products.

PART 2 PRODUCTS

2.01 CLEANING MATERIALS

A. Degreaser:

1. Manufacturers:

a. Euclid Chemical Company; Euco Clean and Strip: www.euclidchemical.com/#sle.

b. L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc; CITREX: www.lmcc.com/#sle.

c. SpecChem, LLC; Orange Peel-Citrus Cleaner: www.specchemllc.com/#sle.

d. Substitutions: See Section 01 6000 - Product Requirements.

B. Detergent: Non-ionic detergent.

C. Alkaline Cleaning Agent:.

D. Acidic Cleaning Agent:.

E. Blasting Medium: .

2.02 CEMENTITIOUS PATCHING AND REPAIR MATERIALS

A. Manufacturers:

1. Adhesives Technology Corporation: www.atcepoxy.com/#sle.
2. ARDEX Engineered Cements: www.ardexamericas.com/#sle.
3. Dayton Superior Corporation: www.daytonsuperior.com/#sle.
4. Euclid Chemical Company: www.euclidchemical.com/#sle.
5. Kaufman Products Inc: www.kaufmanproducts.net/#sle.
6. Master Builders Solutions by BASF: www.master-builders-solutions.basf.us/en-us/#sle.
7. The QUIKRETE Companies: www.quikrete.com/#sle.
8. SpecChem, LLC: www.specchemllc.com/#sle.
9. Stauf USA LLC: www.staufusa.com/#sle.
10. Substitutions: See Section 01 6000 - Product Requirements.

B. Bonding Slurry: Water-based latex admixture complying with ASTM C1059/C1059M, combined with Portland cement and sand in accordance with admixture manufacturer's instructions.

1. Admixture Manufacturers:

a. Dayton Superior Corporation; Acrylic Bonding Agent J40: www.daytonsuperior.com/#sle.

b. Euclid Chemical Company; AKKRO-7T: www.euclidchemical.com/#sle.

c. The QUIKRETE Companies; QUIKRETE® Concrete Bonding Adhesive: www.quikrete.com/#sle.

d. SpecChem, LLC; Strong Bond - Acrylic Bonder: www.specchemllc.com/#sle.

e. W. R. Meadows, Inc; Acry-lok: www.wrmeadows.com/#sle.

f. Substitutions: See Section 01 6000 - Product Requirements.

C. Cementitious Resurfacing Mortar: One- or two-component, factory-mixed, polymer-modified cementitious mortar designed for continuous thin-coat application.

1. In-place material resistant to freeze/thaw conditions.
2. Mixed with water or latex type bonding agent in proportions as recommended by manufacturer.
3. Integral corrosion inhibitor.
4. Recommended Thickness: Feather edge to 1/8 inch (Feather edge to 3 mm).
5. Color: Gray.

6. Manufacturers:
    a. Euclid Chemical Company; THIN TOP SUPREME: www.euclidchemical.com/#sle.
    b. Kaufman Products Inc; Patchwell Deep Light: www.kaufmanproducts.net/#sle.
    c. SpecChem, LLC: Duo Patch: www.specchemllc.com/#sle.
    d. Xypex Chemical Corporation; XYPEX Megamix II: www.xypex.com/#sle.
    e. Substitutions: See Section 01 6000 - Product Requirements.

D. Cementitious Repair Mortar, Trowel Grade: One- or two-component, factory-mixed, polymer-modified cementitious mortar.
    1. In-place material resistant to freeze/thaw conditions.
    2. Mixed with water or latex type bonding agent in proportions as recommended by manufacturer.
    3. Products:
        a. ARDEX Engineered Cements; ARDEX Feather Finish: www.ardexamericas.com/#sle.
        b. Adhesives Technology Corporation; HARD-ROK JET PATCH: www.atcepoxy.com/#sle.
        c. Dayton Superior Corporation; Civil/Structural VO: www.daytonsuperior.com/#sle.
        d. Euclid Chemical Company; EXPRESS REPAIR: www.euclidchemical.com/#sle.
        e. Euclid Chemical Company; EucoRepair V100: www.euclidchemical.com/#sle.
        f. Five Star Products, Inc; Five Star Structural Concrete V/O: www.fivestarproducts.com/#sle.
        g. Kaufman Products Inc; Patchwell Deep Light: www.kaufmanproducts.net/#sle.
        h. The QUIKRETE Companies; QUIKRETE® FastSet Repair Mortar: www.quikrete.com/#sle.
        i. SpecChem, LLC; SpecPatch: www.specchemllc.com/#sle.
        j. W. R. Meadows, Inc; Meadow-Patch T1, Meadow-Patch T2, Meadow-Patch 5, or Meadow-Patch 20: www.wrmeadows.com/#sle.
        k. Substitutions: See Section 01 6000 - Product Requirements.

E. Cementitious Repair Mortar, Form and Pour/Pump Grade: Flowable, one- or two-component, factory-mixed, polymer-modified cementitious mortar; in-place material resistant to freeze/thaw conditions.
    1. Mixed with water in proportions as recommended by manufacturer.
    2. Integral corrosion inhibitor.
    3. Manufacturers:
        a. ARDEX Engineered Cements; ARDEX FDM: www.ardexamericas.com/#sle.
        b. Dayton Superior Corporation; Civil/Structural FPX : www.daytonsuperior.com/#sle.
        c. Euclid Chemical Company; EUCOCRETE: www.euclidchemical.com/#sle.
        d. Euclid Chemical Company; EUCOCRETE SUPREME: www.euclidchemical.com/#sle.
        e. Five Star Products, Inc; Five Star Structural Concrete: www.fivestarproducts.com/#sle.
        f. Kaufman Products Inc; Patchwell Deep: www.kaufmanproducts.net/#sle.
        g. SpecChem, LLC; RepCon H-350; www.specchemllc.com/#sle.
        h. W. R. Meadows, Inc; Meadow-Crete FNP: www.wrmeadows.com/#sle.
        i. Substitutions: See Section 01 6000 - Product Requirements.

F. Cementitious Pavement Repair Mortar: Fast hardening, flowable; composed of cement, sand, and additives; capable of setting in cold weather conditions without the aid of chloride- or gypsum-based accelerators; in-place material resistant to freeze/thaw conditions.
   1. Dry Material: Complies with ASTM C928/C928M.
   2. Integral corrosion inhibitor.
   3. Time To Open To Traffic: 6 hours, maximum.
   4. Time to Top-Coating: 4 hours, maximum.
   5. Manufacturers:
      a. ARDEX Engineered Cements; ARDEX ERM: www.ardexamericas.com/#sle.
      b. ARDEX Engineered Cements; ARDEX CD: www.ardexamericas.com/#sle.
      c. ARDEX Engineered Cements; ARDEX Fine CD: www.ardexamericas.com/#sle.
      d. Dayton Superior Corporation; HD 50 : www.daytonsuperior.com/#sle.
      e. Kaufman Products Inc; Duracrete II: www.kaufmanproducts.net/#sle.
      f. Kaufman Products Inc; Duracrete II FT: www.kaufmanproducts.net/#sle.
      g. Kaufman Products Inc; Duracrete II VOFT: www.kaufmanproducts.net/#sle.
      h. SpecChem, LLC; RepCon 928: www.specchemllc.com/#sle.
      i. SpecChem, LLC; RepCon 928 FS: www.specchemllc.com/#sle.
      j. Substitutions: See Section 01 6000 - Product Requirements.

G. Cementitious Hydraulic Waterstop: Very fast setting, low slump, hand formable, and capable of stopping active water leaks; in-place material resistant to freeze/thaw conditions.
   1. Manufacturers:
      a. Dayton Superior Corporation; Waterstop : www.daytonsuperior.com/#sle.
      b. Euclid Chemical Company; SPEED PLUG: www.euclidchemical.com/#sle.
      c. Kaufman Products Inc; SurePlug - regular set: www.kaufmanproducts.net/#sle.
      d. Kaufman Products Inc; HiCap: www.kaufmanproducts.net/#sle.
      e. SpecChem, LLC; SpecPlug or Super SpecPlug; www.specchemllc.com/#sle.
      f. W. R. Meadows, Inc; Meadow-Plug or Meadow-Patch 5: www.wrmeadows.com/#sle.

H. Exterior Self-Leveling Concrete Topping: Portland cement-based; suitable as wear surface topping in exterior and wet locations as well as underlayment for applied materials.
   1. Compressive Strength: 4300 pounds per square inch (30 MPa), minimum, at 28 days, when tested in accordance with ASTM C109/C109M, air cured.
   2. Flexural Strength: 1000 pounds per square inch (7 MPa), minimum, at 28 days, when tested in accordance with ASTM C348.
   3. Manufacturers:
      a. ARDEX Engineered Cements; ARDEX K301: www.ardexamericas.com/#sle.
      b. Kaufman Products Inc; SureFlow 042: www.kaufmanproducts.net/#sle.
      c. Substitutions: See Section 01 6000 - Product Requirements.

I. Pre-Blended Concrete Mix for Small Projects: Construction-grade Portland cement uniformly blended with aggregates and other approved concrete ingredients, requiring only the addition of water.

1. Compressive Strength: 4000 pounds per square inch (27.6 MPa), minimum, at 28 days, when tested in accordance with ASTM C39/C39M.
2. Manufacturers:
    a. The QUIKRETE Companies; QUIKRETE® Concrete Mix: www.quikrete.com/#sle.
    b. The QUIKRETE Companies; QUIKRETE® Crack Resistant Concrete Mix: www.quikrete.com/#sle.
    c. Substitutions: See Section 01 6000 - Product Requirements.

2.03 EPOXY PATCHING AND REPAIR MATERIALS

A. Manufacturers:

1. Adhesives Technology Corporation: www.atcepoxy.com/#sle.
2. Chase Construction Products: www.chasecorp.com/#sle.
3. Euclid Chemical Company: www.euclidchemical.com/#sle.
4. Kaufman Products Inc.: www.kaufmanproducts.net/#sle.
5. SpecChem, LLC: www.specchemllc.com/#sle.
6. W. R. Meadows, Inc: www.wrmeadows.com/#sle.
7. Substitutions: See Section 01 6000 - Product Requirements.

B. Epoxy Repair Mortar: Epoxy resin mixed with aggregate and other materials in accordance with manufacturer's instructions for purpose intended; comply with pot life and workability limits.

1. Manufacturers:
    a. Adhesives Technology Corporation; Crackbond LR-321: www.atcepoxy.com/#sle.
    b. ARDEX Engineered Cements; ARDEX BACA: www.ardexamericas.com/#sle.
    c. Dayton Superior Corporation; Sure Patch: www.daytonsuperior.com/#sle.
    d. Dayton Superior Corporation; Sure Fil J52: www.daytonsuperior.com/#sle.
    e. Dayton Superior Corporation; Sure Seal LV/LM: www.daytonsuperior.com/#sle.
    f. Dayton Superior Corporation; Pro-Flex: www.daytonsuperior.com/#sle.
    g. Euclid Chemical Company; DURALFLEX FASTPATCH: www.euclidchemical.com/#sle.
    h. Kaufman Products Inc; SurePoxy Mortar, SurePoxy HMLV, or SurePoxy HMLV Class B: www.kaufmanproducts.net/#sle.
    i. LATICRETE International; SPARTACOTE™ Epoxy Fill Coat: www.laticrete.com/#sle.
    j. The QUIKRETE Companies; QUIKRETE® FastSet Anchoring Epoxy: www.quikrete.com/#sle.
    k. SpecChem, LLC; SpecPoxy 1000, SpecPoxy 2000, SpecPoxy 3000 or SpecPoxy 3000 FS: www.specchemllc.com/#sle.
    l. W. R. Meadows, Inc; Rezi-Weld Gel Paste, Rezi-Weld Gel Paste State, Rezi-Weld 1000, Rezi-Weld LV, or Rezi-Weld LV State: www.wrmeadows.com/#sle.
    m. Substitutions: See Section 01 6000 - Product Requirements.

C. Epoxy Injection Adhesive:

1. Manufacturers:
    a. Adhesives Technology Corporation; Crackbond LR-321: www.atcepoxy.com/#sle.
    b. Dayton Superior Corporation; Sure Inject J56 SLV: www.daytonsuperior.com/#sle.
    c. Dayton Superior Corporation; Pro-Poxy 100 : www.daytonsuperior.com/#sle.
    d. Kaufman Products Inc; SurePoxy HMLV, SurePoxy HMLV Class B, or SurePoxy HMSLV: www.kaufmanproducts.net/#sle.
    e. SpecChem, LLC; SpecPoxy 1000; www.specchemllc.com/#sle.
    f. W. R. Meadows, Inc; Rezi-Weld LV, Rezi-Weld LV State, Rezi-Weld (IP), or Rezi-Weld Gel Paste: www.wrmeadows.com/#sle.
    g. Substitutions: See Section 01 6000 - Product Requirements.

D. Epoxy Bonding Adhesive: Non-sag, two-part, 100 percent solids; recommended by manufacturer for purpose and conditions under which used.
    1. Non-Load-Bearing Applications: ASTM C881/C881M Type I, II, III, IV, or V, whichever is appropriate to application.
    2. Load-Bearing Applications: ASTM C881/C881M Type IV or V, whichever is appropriate to application.
    3. Other Applications: ASTM C881/C881M Type as appropriate to application.
    4. Manufacturers:
        a. ARDEX Engineered Cements; ARDEX BACA: www.ardexamericas.com/#sle.
        b. Adhesives Technology Corporation; Crackbond LR-321: www.atcepoxy.com/#sle.
        c. Adhesives Technology Corporation; Crackbond SLV-302: www.atcepoxy.com/#sle.
        d. Adhesives Technology Corporation; Ultrabond 2100: www.atcepoxy.com/#sle.
        e. Dayton Superior Corporation; Sure Bond J58 : www.daytonsuperior.com/#sle.
        f. Euclid Chemical Company; DURALFLEX GEL: www.euclidchemical.com/#sle.
        g. Euclid Chemical Company; DURALFLEX LV: www.euclidchemical.com/#sle.
        h. Euclid Chemical Company; DURAL 452 GEL, DURAL 452 LV, or DURAL 452 MV: www.euclidchemical.com/#sle.
        i. Kaufman Products Inc; SurePoxy HM Gel: www.kaufmanproducts.net/#sle.
        j. SpecChem, LLC; SpecPoxy 3000 FS: www.specchemllc.com/#sle.
        k. W. R. Meadows, Inc; Rezi-Weld 1000: www.wrmeadows.com/#sle.
        l. Substitutions: See Section 01 6000 - Product Requirements.

2.04 POLYURETHANE PATCHING AND REPAIR MATERIALS

A. Manufacturers:
    1. Adhesives Technology Corporation: www.atcepoxy.com/#sle.
    2. ARDEX Engineered Cements: www.ardexamericas.com/#sle.
    3. Substitutions: See Section 01 6000 - Product Requirements.

B. Polyurethane Repair Gel:
    1. Manufacturers:

a. Adhesives Technology Corporation; Crackbond CSR: www.atcepoxy.com/#sle.

b. ARDEX Engineered Cements; ARDEX ArdiFix: www.ardexamericas.com/#sle.

c. Substitutions: See Section 01 6000 - Product Requirements.

2.05 ACCESSORIES

A. Anchoring Adhesive: Self-leveling or non-sag as applicable.

1. Self-Leveling Polyester-Based Products:

a. W. R. Meadows, Inc; Poly-Grip: www.wrmeadows.com/#sle.

b. Substitutions: See Section 01 6000 - Product Requirements.

2. Self-Leveling Epoxy Products:

a. Euclid Chemical Company; DURAL FAST SET LV: www.euclidchemical.com/#sle.

b. SpecChem, LLC; SpecPoxy 2000; www.specchemllc.com/#sle.

c. W. R. Meadows, Inc; Rezi-Weld 1000, Rezi-Weld (IP), or Rezi-Weld 3/2: www.wrmeadows.com/#sle.

d. Substitutions: See Section 01 6000 - Product Requirements.

3. Non-Sag Epoxy Products:

a. Dayton Superior Corporation; Sure Anchor J50, Sure Anchor I J51, All Weather J51 AW, Pro-Poxy 300, Pro-Poxy 300 FAST, Pro-Poxy 400, or Pro-Poxy 500 : www.daytonsuperior.com/#sle.

b. Euclid Chemical Company; DURAL FAST SET GEL: www.euclidchemical.com/#sle.

c. SpecChem, LLC; SpecPoxy 3000 or SpecPoxy 3000 FS: www.specchemllc.com/#sle.

d. W. R. Meadows, Inc; Rezi-Weld Gel Paste or Rezi-Weld Gel Paste State: www.wrmeadows.com/#sle.

e. Substitutions: See Section 01 6000 - Product Requirements.

B. Portland Cement: ASTM C150/C150M, Type I, grey.

C. Sand: ASTM C33/C33M or ASTM C404; uniformly graded, clean.

D. Water: Clean and potable.

E. Reinforcing Steel: ASTM A615/A615M Grade 40 (40,000 psi) (280 MPa) billet-steel deformed bars, unfinished.

F. Reinforcing Steel: Deformed bars, ASTM A996/A996M Grade 40 (280), Type A.

1. Galvanized in accordance with ASTM A767/A767M, Class I.

G. Stirrup Steel: ASTM A1064/A1064M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Beginning of installation means acceptance of substrate.

3.02 PREPARATION

A. Prepare concrete surfaces to be repaired according to ICRI 310.2R.

3.03 CLEANING EXISTING CONCRETE

A. Provide enclosures, barricades, and other temporary construction as required to protect adjacent work from damage.

B. Clean concrete surfaces of dirt or other contamination using the gentlest method that is effective.

1. Try the gentlest method first, then, if not clean enough, use a less gentle method taking care to watch for impending damage.
2. Clean out cracks and voids using same methods.

C. The following are acceptable cleaning methods, in order from gentlest to less gentle:

1. Water washing using low-pressure, maximum of 100 psi, and, if necessary, brushes with natural or synthetic bristles.
2. Increasing the water washing pressure to maximum of 400 psi.
3. Adding detergent to washing water; with final water rinse to remove residual detergent.
4. Steam-generated low-pressure hot-water washing.
5. Alkaline cleaning agent applied for the least amount of time that is effective, followed by slight acid rinse and water rinse.
6. Acidic cleaning agent applied for the least amount of time that is effective, followed by water rinse. Test acidic cleaning agents on mock-up surfaces prior to use.
7. Abrasive blasting: Use only abrasive media that have been proven not to damage concrete by testing on mock-up.

D. Do not use any of the following cleaning methods, unless otherwise indicated:

1. Brushes with wire bristles, grinding with abrasives, solvents, hydrochloric or muriatic acid, sodium hydroxide, caustic soda, or lye.
2. Soap or detergent that is not non-ionic.

3.04 PAINT AND GRAFFITI REMOVAL

3.05 CONCRETE STRUCTURAL MEMBER REPAIR

A. See drawings for specific areas to be repaired.

B. Remove broken and soft concrete at least 1/4 inch (6 mm) deep.

C. Mechanically cut away damaged portions of reinforcement.

D. Remove corrosion from steel and clean mechanically.

E. Blast clean remaining exposed reinforcement surfaces.

F. Repair by welding new bar reinforcement to existing reinforcement using sleeve splices.

1. Perform welding work in accordance with AWS D1.4/D1.4M.
2. Make welded sleeve splices to achieve strength to exceed strength of new reinforcement.

G. Follow repair product manufacturer's written installation instructions.

H. Cover exposed steel reinforcement with epoxy mortar.

I. Work epoxy mortar into broken surface and build up patch to match original.

J. Feather edges of repairs flush to sound surface and trowel surface to match surrounding area.

3.06 CRACK REPAIR USING EPOXY ADHESIVE INJECTION

A. Repair exposed cracks.

B. Provide temporary entry ports spaced to accomplish movement of fluids between ports; no deeper than the depth of the crack to be filled or port size diameter no greater than the thickness of the crack. Provide temporary seal at concrete surface to prevent leakage of adhesive.

C. Inject adhesive into ports under pressure using equipment appropriate for particular application.

D. Begin injection at lower entry port and continue until adhesive appears in adjacent entry port. Continue from port to port until entire crack is filled.

E. Remove temporary seal and excess adhesive.

F. Clean surfaces adjacent to repair and blend finish.

3.07 CONCRETE SURFACE REPAIR USING CEMENTITIOUS MATERIALS

A. Clean concrete surfaces, cracks, and joints of dirt, laitance, corrosion, and other contamination using method(s) specified above and allow to dry.

B. Apply coating of bonding agent to entire concrete surface to be repaired.

C. Fill voids with cementitious mortar flush with surface.

D. Apply repair mortar by steel trowel to a minimum thickness of 1/4 inch (6 mm) over entire surface, terminating at a vertical change in plane on all sides.

E. Trowel finish to match adjacent concrete surfaces.

3.08 FIELD QUALITY CONTROL

A. An independent testing agency, as specified in Section 01 4000, will perform field inspection and testing.

1. Test concrete for calcium chloride content during the execution of the Work.

END OF SECTION

SECTION 03 0516
UNDERSLAB VAPOR BARRIER

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sheet vapor barrier under concrete slabs on grade.

1.02 RELATED REQUIREMENTS

A. Section 03 1000 - Concrete Forming and Accessories: Forms and accessories for formwork.

B. Section 03 2000 - Concrete Reinforcing.

C. Section 03 3000 - Cast-in-Place Concrete: Preparation of subgrade, granular fill, placement of concrete.

1.03 REFERENCE STANDARDS

A. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs 2011 (Reapproved 2017).

B. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs 2017.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products.

C. Test Data: Submit report of tests showing compliance with specified requirements.

D. Samples: Submit samples of underslab vapor barrier to be used.

E. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction.

PART 2 PRODUCTS

2.01 MATERIALS

A. Underslab Vapor Barrier:

1. Water Vapor Permeance: Not more than 0.010 perms (0.6 ng/(s m2 Pa)), maximum.
2. Thickness: 15 mils (0.4 mm).
3. Basis of Design:
    a. Stego Industries LLC; Stego Wrap Vapor Barrier (15-mil): www.stegoindustries.com/#sle.

B. Accessory Products: Vapor barrier manufacturer's recommended tape, adhesive, mastic, etc., for sealing seams and penetrations in vapor barrier.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surface over which vapor barrier is to be installed is complete and ready before proceeding with installation of vapor barrier.

3.02 INSTALLATION

A. Install vapor barrier in accordance with manufacturer's instructions and ASTM E1643.

B. Install vapor barrier under interior slabs on grade; lap sheet over footings and seal to foundation walls.

C. Lap joints minimum 6 inches (150 mm).

D. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions.

E. No penetration of vapor barrier is allowed except for reinforcing steel and permanent utilities.

F. Repair damaged vapor retarder before covering with other materials.

END OF SECTION

SECTION 03 1000
CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.

B. Openings for other work.

C. Form accessories.

D. Form stripping.

1.02 RELATED REQUIREMENTS

A. Section 03 2000 - Concrete Reinforcing.

B. Section 03 3000 - Cast-in-Place Concrete.

C. Section 03 3523 - Exposed Aggregate Concrete Finishing.

D. Section 03 3800 - Post-Tensioned Concrete.

E. Section 04 2000 - Unit Masonry: Reinforcement for masonry.

F. Section 04 2001 - Masonry Veneer: Spacing for veneer anchor reglets recessed in concrete.

G. Section 04 2500 - Unit Masonry Panels: Reinforcement for prefabricated masonry.

H. Section 04 2900 - Engineered Unit Masonry: Reinforcement for engineered masonry.

I. Section 05 1200 - Structural Steel Framing: Placement of embedded steel anchors and plates in cast-in-place concrete.

J. Section 05 2100 - Steel Joist Framing: Placement of embedded steel anchors, plates and joist seats in cast-in-place concrete.

K. Section 05 3100 - Steel Decking: Placement of steel anchors in composite decking.

L. Section 31 2316 - Excavation: Shoring and underpinning for excavation.

M. Section 31 6216.13 - Sheet Steel Piles: Shoring and underpinning related to sheet piles.

N. Section 31 6614 - Hydraulically Driven Pier Foundations: Shoring and underpinning related to hydraulically driven piles.

1.03 REFERENCE STANDARDS

A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials 2010 (Reapproved 2015).

B. ACI 301 - Specifications for Structural Concrete 2016.

C. ACI 318 - Building Code Requirements for Structural Concrete and Commentary 2014 (Errata 2018).

D. ACI 347R - Guide to Formwork for Concrete 2014.

E. ASME A17.1 - Safety Code for Elevators and Escalators 2016.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2017.

G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2014.

H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2013.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on void form materials and installation requirements.

C. Shop Drawings: Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design formwork under direct supervision of a Professional Structural Engineer experienced in design of concrete formwork and licensed in Maryland .

B. Maintain one copy of each installation standard on site throughout the duration of concrete work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver prefabricated forms and installation instructions in manufacturer's packaging.

B. Store prefabricated forms off ground in ventilated and protected manner to prevent deterioration from moisture.

1.07 DESIGN OF FORMWORK

A. Design, erect, support, brace and maintain formwork so that it will safely support all vertical and lateral loads that might be applied until such loads can be supported by the concrete structure. Carry vertical and lateral loads to the ground by the formwork system and by the in-place construction that has attained adequate strength for that purpose. Concrete work has been designed to safely support construction loads, including reshoring loads. If the contractor is uncertain about the design live loads, it shall be his responsibility to obtain these from the Architect.

B. Design forms and falsework to include assumed values of live load, dead load, weight of moving equipment operated of formwork, concrete mix, height of concrete drop, vibrator frequency, ambient temperature, foundation pressures, stresses, lateral stability, and other factors pertinent to safety of the structure during construction.

C. Provide shores and struts with positive means of adjustment capable of taking up all formwork settlement during concrete placing operations, using wedges or jacks or combination thereof. Provide trussed supports when adequate foundations for shores and struts cannot be secured.

D. Support form facing materials by structural members spaced sufficiently close to prevent deflection of the form facing material. Fit forms placed in successive unit for continuous surfaces to accurate alignment to assure a smooth completed surface, free from irregularities and within the allowable tolerances. Provide camber in formwork as required for anticipated deflections in formwork due to weight and pressure of fresh concrete and construction loads for long-span members without intermediate supports. Final position of all structural members to be at elevations shown on drawings.

E. Design formwork to be readily removable without impact, shock or damage to the cast-in-place concrete surfaces and adjacent materials.

F. Provide formwork sufficiently tight to prevent leakage of cement past during concrete placement. Solidly butt all joints and provide backup material at joints as may be required to prevent leakage and fins.

PART 2 PRODUCTS

2.01 FORMWORK - GENERAL

A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.

B. Design and construct concrete that complies with design with respect to shape, lines, and dimensions.

C. Chamfer outside corners of beams, joists, columns, and walls.

D. Chamfer exposed external corners and edges where shown, using chamfer strips accurately fabricated to produce uniform smooth lines and tight edge joints. Provide chamfers of wood, metal, PVC, or rubber, to form the required corner or edge shapes as shown on contract documents.

E. Carefully form intersecting planes to provide true, clean-cut corners, with edge grain of plywood not exposed as form for concrete. Back joints with extra studs or girts as required to maintain true and square intersections.

F. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.

G. Comply with relevant portions of ACI 347R, ACI 301 and ACI 318.

2.02 EXPOSED FINISHED CONCRETE

A. Forms for Exposed Finish Concrete:

1. Unless otherwise shown or specified, construct all formwork for exposed concrete surfaces with plywood, metalframed plywood-faced, or other panel type materials acceptable to the Architect, to provide continuous, straight smooth exposed surfaces. Furnish in the largest practical sizes to minimize number of joints and to conform to the joint system shown on the drawings.

2. Provide form material with sufficient thickness to withstand the pressure of newly placed concrete without bow or deflections.

3. Drill forms to suit ties used and to prevent leakage of concrete mortar around tie holes. Do not splinter forms by driving ties through improperly prepared holes. Do not use cover plates for patching holes or defects in forms.

B. Exposed finished concrete shall be defined to mean any vertical surface or soffit concrete exposed to sight; i.e., exterior grade beams, retaining walls, etc. Hand rubbing of concrete surfaces is only required at locations indicated on the drawings.

2.03 REMOVABLE PREFABRICATED FORMS

A. Preformed Steel Forms: Minimum 16 gage, 0.0598 inch (1.52 mm) thick, matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

B. Preformed Aluminum Forms: ASTM B221 (ASTM B221M), 6061-T6 alloy, matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

C. Preformed Plastic Forms: Thermoplastic polystyrene form liner, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

D. Void Forms: Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete mix until initial set; 2 inches (50 mm) thick.

2.04 FORMWORK ACCESSORIES

A. Form Ties: Removable type, galvanized metal, fixed length, cone type, with waterproofing washer, free of defects that could leave holes larger than 1 inch (25 mm) in concrete surface.

B. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.

1. Composition: Colorless reactive, mineral oil-based, soy-based or vegetable-oil based compound.
2. Do not use materials containing diesel oil or petroleum-based compounds.
3. VOC Content: In compliance with applicable local, State, and federal regulations.

C. Filler Strips for Chamfered Corners: type; size; maximum possible lengths.

D. Dovetail Anchor Slot: Galvanized steel, at least 22 gage, 0.0299 inch (0.76 mm) thick, foam filled, release tape sealed slots, anchors for securing to concrete formwork.

E. Flashing Reglets: Galvanized steel, at least 22 gage, 0.0299 inch (0.76 mm) thick, longest possible lengths, with alignment splines for joints, foam filled, release tape sealed slots, anchors for securing to concrete formwork.

F. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

G. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 05 1200.

H. Waterstops: Preformed mineral colloid strips, 3/8 inch (9 mm) thick, moisture expanding.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Align joints and make watertight. Keep form joints to a minimum.

D. Construct forms to the exact sizes, shapes, lines and dimensions on contract documents, and as required to obtain accurate alignment, locations, grades, level and plumb work in the finished structures.

E. Coordinate this section with other sections of work that require attachment of components to formwork.

F. Obtain approval before framing openings in structural members that are not indicated on drawings.

G. Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.

H. Coordinate this section with other sections of work that require attachment of components to formwork.

3.03 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

3.04 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.

B. Position recessed anchor slots for brick veneer masonry anchors to spacing and intervals specified in Section 04 2001.

C. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

D. Install waterstops in accordance with manufacturer's instructions, so they are continuous without displacing reinforcement. Heat seal joints so they are watertight.

E. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

F. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

G. Obtain approval before framing openings in structural members that are not indicated on drawings.

H. Provide for openings, offsets, sinkage, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required on the work, and shown in the architectural, structural, and any other pertinent parts of the contract drawings. Use selected materials to obtain the required finishes.

I. Provide openings in concrete framework to accommodate work of other trades, including those under separate prime contracts. Size and location of openings, recesses and chases are the responsibility of the trade requiring such items. No hole, blockout, or recess shall be allowed in any structural member without the written approval of the Architect. Accurately place and securely support items to be built into forms.

J. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent the loss of concrete mortar. Locate consistent with the requirements of the work, and not in any exposed surface.

K. Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.

3.05 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is to be placed. Retighten forms immediately after concrete placement as required to eliminate mortar leaks.

C. Clean formed cavities of debris prior to placing concrete.

1. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

2. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.06 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 117, unless otherwise indicated.

B. Camber slabs and beams in accordance with ACI 301.

3.07 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.

B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

3.08 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Formwork not supporting the weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed 24 hours after placing the concrete, providing the concrete is sufficiently hard to not be damaged by the form removal operations, and provided that curing and protection operations are maintained.

C. Form removal timeframes:

1. Formwork supporting the weight of concrete, such as beam soffits, joists, slabs and other structural elements of work, shall not be removed in less than fourteen (14) days or until the concrete has attained 70% of the design minimum compressive strength for the applicable type of concrete. Determine potential compressive strength of in-place concrete by testing of field-cured specimens representative of the concrete location or members.

2. Form facing material may be removed four (4) days after placement, only if the shores and other vertical supports have been arranged to permit removal of the form facing material without loosening or disturbing the shores and supports.

3. These periods indicated above represent the cumulative number of days or fractions thereof, not necessarily consecutive, during which the temperature of the concrete is above 50 degrees F.

D. Re-use of forms:

1. Clean and repair the surfaces of forms that are to be re-used in the work, except that split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to all concrete contact form surfaces as specified for new formwork.

2. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure all joints to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to the Architect.

E. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

F. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

END OF SECTION

SECTION 03 1521
TERMITE BARRIER

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Termite-resistant vapor barrier sheet.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Vapor barrier placement under concrete slab-on-grade.

1.03 PRICE AND PAYMENT PROCEDURES

A. See Section 01 2200 - Unit Prices, for additional unit price requirements.

B. Termite Barrier: By the square foot (square meter) of installed termite barrier.

1.04 REFERENCE STANDARDS

A. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs 2011 (Reapproved 2017).

B. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs 2017.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements.

C. Test Reports: Submit manufacturer's summary of independent laboratory and field testing for effectiveness in subterranean termite exclusion.

D. Manufacturer's Installation Instructions.

E. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.

F. Warranty: Submit warranty and ensure that forms have been completed in Owner's name.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing this type of work and:

1. Having minimum of 2 years documented experience.
2. Approved by manufacturer of treatment materials.
3. Licensed in Maryland.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer's limited warranty.

PART 2 PRODUCTS

2.01 TERMITE BARRIER SHEET

A. Termite-Resistant Vapor Barrier Sheet: Plastic sheet complying with ASTM E1745, Class C; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs, and for exclusion of subterranean termites.

B. Accessory Products: Barrier sheet manufacturer's recommended tape, adhesive, etc., for sealing seams and penetrations in termite barrier.

C. Manufacturer: Stego Technology LLC; Pango Wrap with Pango Tape: www.stegoindustries.com/#sle.

D. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that soil surfaces are unfrozen.

B. Verify final grading is complete.

3.02 INSTALLATION - BARRIER SHEET

A. Comply with ASTM E1643.

B. Lap joints 6 inches (150 mm), minimum. Seal joints, seams, penetrations, and edges at adjacent materials with manufacturer's recommended products and follow manufacturer's written instructions.

3.03 PROTECTION

A. Protect sheet materials from damage after completed installation.

B. Repair damage to installed sheet materials with manufacturer's recommended products and according to the manufacturer's written instructions.

END OF SECTION

SECTION 03 2000
CONCRETE REINFORCING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reinforcing steel for cast-in-place concrete.

B. Supports and accessories for steel reinforcement.

1.02 RELATED REQUIREMENTS

A. Section 03 1000 - Concrete Forming and Accessories.

B. Section 03 3000 - Cast-in-Place Concrete.

C. Section 03 3713 - Shotcrete: Reinforcement for shotcrete.

D. Section 03 4500 - Precast Architectural Concrete: Reinforcement for precast concrete panels.

E. Section 04 2000 - Unit Masonry: Reinforcement for masonry.

F. Section 04 2001 - Masonry Veneer: Spacing for veneer anchor reglets recessed in concrete.

G. Section 04 2500 - Unit Masonry Panels: Reinforcement for prefabricated masonry.

H. Section 04 2900 - Engineered Unit Masonry: Reinforcement for engineered masonry.

I. Section 26 0526 - Grounding and Bonding for Electrical Systems: Grounding connection to concrete reinforcement.

J. Section 31 6223.13 - Concrete-Filled Steel Piles: Reinforcement for pile foundations.

K. Section 31 6329 - Drilled Concrete Piers and Shafts: Reinforcement for drilled pier foundations.

1.03 REFERENCE STANDARDS

A. ACI 301 - Specifications for Structural Concrete 2016.

B. ACI 318 - Building Code Requirements for Structural Concrete and Commentary 2014 (Errata 2018).

C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2018, with Editorial Revision (2018).

D. ASTM A704/A704M - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement 2018.

E. ASTM A706/A706M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement 2016.

F. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement 2016.

G. ASTM A775/A775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars 2017.

H. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement 2014.

I. ASTM A996/A996M - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement 2016.

J. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2018.

K. ASTM D3963/D3963M - Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars 2015.

L. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel 2011.

M. CRSI (DA4) - Manual of Standard Practice 2009.

N. CRSI (P1) - Placing Reinforcing Bars 2011.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.

1. Prepare shop drawings under seal of a Professional Structural Engineer experienced in design of work of this type and licensed in Maryland .

C. Provide bar schedules, stirrup spacing, and diagrams of bent bars.

D. Do not place any reinforcing until Shop Drawings are approved.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301.

B. Welders' Certificates: Submit certifications for welders employed on the project, verifying AWS qualification within the previous 12 months.

C. Comply with the most current accepted code of Prince George's County, Maryland.

D. Installer Qualifications: A company specializing in placement of concrete reinforcement steel, with a minimum of 3 years experience on projects of similar size and scope.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver reinforcement to project site in bundles marked with metal tags indicating bar size and length.

B. Protect concrete reinforcement before, during and after installation and the installed work and materials of other sections.

C. Store in a manner to prevent excessive rusting and fouling with dirt, grease, and other bond-breaking coatings.

D. Maintain identification after bundles are broken.

E. In event of damage, immediately make repairs and replacements necessary.

PART 2 PRODUCTS

2.01 REINFORCEMENT

A. All materials shall be new, free from rust and comply with the following:

1. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa).
2. Plain billet-steel bars.
3. Galvanized in accordance with ASTM A767/A767M, Class I.
4. Wire fabric: ASTM A185.
5. Bar supports: "Bar Support Specifications," CRSI Manual of Standard Practice, Type: plastic tipped accessories.
6. Reinforcing Steel: ASTM A706/A706M, deformed low-alloy steel bars.
7. Reinforcing Steel: Deformed bars, ASTM A996/A996M Grade 40 (280), Type A.
8. Epoxy coated in accordance with ASTM A775/A775M.

9. Stirrup Steel: ASTM A1064/A1064M steel wire, unfinished.
10. Steel Welded Wire Reinforcement (WWR): Galvanized, deformed type; ASTM A1064/A1064M.
11. Reinforcement Accessories:
    a. Tie Wire: Annealed, minimum 16 gage, 0.0508 inch (1.29 mm).
        1) Supports for reinforcement: Provide supports including bolsters, chairs, spacers and other devices for supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI recommendations.
        2) For exposed-to-view concrete surfaces and where support legs are in contact with forms, provide supports with plastic protection (CRSI, Class1) or stainless steel protection (CRSI, Class 2).
12. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.

2.02 RE-BAR SPLICING:

A. Coupler Systems: Mechanical devices for splicing reinforcing bars; capable of developing full steel reinforcing design strength in tension and compression.

B. Dowel Bar Splicer with Dowel-Ins: Mechanical devices for connecting dowels; capable of developing full steel reinforcing design strength in tension and compression.

C. Grout: Cementitious, non-metallic, non-shrink grout for use with manufacturer's grout sleeve reinforcing bar coupler system.

2.03 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.

B. Fabricate bars with kinks or bends only as indicated on the drawings.

C. Do not field-bend or straighten steel. Do not re-bend or straighten reinforcement to correct fabrication errors.

D. Design:
    1. Bend bars cold.
    2. Make bend for stirrups and ties in accordance with ACI 315.

E. Fabricate and handle epoxy-coated reinforcing in accordance with ASTM D3963/D3963M.

F. Locate reinforcing splices not indicated on drawings at point of minimum stress.
    1. Review locations of splices with Architect .

PART 3 EXECUTION

3.01 PLACEMENT

A. Before start of concrete placement, accurately place concrete reinforcement, positively securing and supporting by concrete blocks, metal chairs or spacers, or metal hangers.

B. Place, support and secure reinforcement against displacement. Do not deviate from required position.

C. Clearance: Clear space between bars and cover for bars shall conform to the Requirements of ACI 318.

D. Splicing:
    1. Horizontal bars:

a. Place bars in horizontal members with laps at splices in accordance with the Contract Documents and the Requirements of ACI-318 (Latest Edition).

b. Bars may be wired together at laps.

c. Wherever possible, stagger the splices of adjacent bars.

2. Wire fabric:

a. Make splices in wire fabric at least 1-1/2 meshes wide.

3. Other splices:

a. Make only those other splices indicated on accepted Shop Drawings or specifically accepted by Architect.

b. Place required steel dowels and securely anchor into position before concrete is placed.

c. In the event conduits, piping, inserts, sleeves or other items interfere with placing reinforcement as indicated or as otherwise required, immediately consult Architect and Owner's Representative and obtain approval of new procedure before placing concrete.

E. Do not displace or damage vapor barrier.

F. Accommodate placement of formed openings.

G. Comply with applicable code for concrete cover over reinforcement.

3.02 CLEANING REINFORCEMENT

A. Steel reinforcement, at the time concrete is placed around it, shall be free from rust scale, loose mill scale, oil, paint, and other coatings which will destroy bond between steel and concrete.

3.03 PROTECTION DURING INSTALLATION

A. Keep reinforcing steel in proper position during concrete placement.

3.04 INSPECTION BEFORE CONCRETE PLACEMENT

A. Do not place any concrete until reinforcing steel has been inspected and approved.

END OF SECTION

SECTION 03 2400
FIBROUS REINFORCING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Steel fiber reinforcing for cast-in-place concrete.

1.02 RELATED REQUIREMENTS

A. Section 03 1000 - Concrete Forming and Accessories.

B. Section 03 2000 - Concrete Reinforcing.

C. Section 03 3000 - Cast-in-Place Concrete.

D. Section 03 3713 - Shotcrete.

1.03 REFERENCE STANDARDS

A. ACI 302.1R - Guide to Concrete Floor and Slab Construction 2015.

B. ACI 318 - Building Code Requirements for Structural Concrete and Commentary 2014 (Errata 2018).

C. ASTM A370 - Standard Test Methods and Definitions for Mechanical Testing of Steel Products 2017a.

D. ASTM A820/A820M - Standard Specification for Steel Fibers for Fiber-Reinforced Concrete 2016.

E. ASTM C1116/C1116M - Standard Specification for Fiber-Reinforced Concrete 2010a (Reapproved 2015).

F. ASTM C1609/C1609M - Standard Test Method for Flexural Performance of Fiber-Reinforced Concrete (Using Beam With Third-Point Loading) 2012.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's product data sheets for specified products..

C. Shop Drawings: Show concrete design with indicated load cases.

1. Wheel loads at center of slab and at dowel joints in kips (kN).
2. Point loads at center of slab and at dowel joints in kips (kN).
3. Linear loads in pounds per linear foot (N/m).
4. Uniform distributed loads in pounds per square foot (Pa, kPa, or MPa).

D. Test Reports: Submit certified copies of manufacturer's test reports for equivalent flexural strength ratio (Re3) and residual strengths (fD,600 and fD,150).

E. Manufacturer's Instructions: Submit manufacturer's handling, dosing, and mixing instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened, and undamaged containers with intact identification labels.

B. Store materials in manufacturer's original containers at temperature and humidity recommended by manufacturer. Protect materials from exposure to harmful conditions.

C. Protect materials from dirt, corrosion, oil, grease, and other contaminants.

PART 2 PRODUCTS

2.01 STEEL FIBER REINFORCING

A. System Requirements for Steel Fiber-Reinforced Concrete:
   1. Design Requirements:
      a. Equivalent Flexural Strength Ratio (Re3) = 0.35, minimum.
      b. Residual Strengths:
         1) fD,600 equals , minimum.
         2) fD,150 equals , minimum.
      c. Verification: Submit manufacturer's reports documenting results of ASTM C1609/C1609M testing on concrete containing similar materials.
   2. Performance Requirements: Ultimate tensile strength of 168,000 pounds per square inch (1158 kPa), minimum, when tested according to ASTM A370.

B. Structural Fiber Reinforcement: ASTM C1116/C1116M.
   1. Length: 2.4 inches (65 mm).
   2. Diameter: 0.04 inch (0.9 mm)
   3. Aspect Ratio (L/D): 65, minimum.
   4. Anchorage: End-deformed.
   5. Surface Condition: Clean; free of rust, oil, and other deleterious materials.
   6. Configuration: Loose, round, drawn wire; end-deformed.

C. Material: Uncoated, low-carbon steel; ASTM A820/A820M, Type 1 cold-drawn wire.

D. Manufacturer:
   1. Bekaert Corporation; Dramix 3D: www.bekaert.com/#sle.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MIXING

A. Steel Fibers: Mix steel fibers into concrete per manufacturer's written instructions.
   1. Steel fibers may be added during or after batching of concrete materials.
   2. Do not place steel fibers as first component in concrete mixer.
   3. Add fibers at maximum rate of 132 pounds per minute (60 kg/min).
   4. Mix concrete for five minutes, minimum, at 12 to 18 revolutions per minute.

B. Slump Adjustment: Adjust concrete mixture to minimum slump of 5 inches (127 mm).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify improvements to existing subgrade comply with manufacturer's recommendations.

3.02 INSTALLATION

A. Comply with manufacturer's written instructions and requirements stated in the manufacturer's product data, technical bulletins, and product packaging.

B. Provide additional reinforcing as recommended by manufacturer.

C. Use well-graded combined aggregate mix. See Section 03 3000 for material requirements and mix design.

1. Cement plus pozzolan content: 575 pounds per cubic yard (341 kg/cu m), maximum.
2. Water-Cement Ratio: Less than 0.50.
3. No water added at site.
4. Adjust slump with plasticizer or superplasticizer only.

D. Form concrete joints to allow unrestrained shrinkage of concrete in two directions.

E. Saw cuts: Make saw cuts one-third concrete depth with wet-cut saw or one-fourth concrete depth with early-entry dry-cut saw.

3.03 PROTECTION

A. Do not disturb concrete paste covering steel fibers during concrete finishing.

B. Protect exposed slab from excessive drying due to wind and temperature.

END OF SECTION

SECTION 03 3000
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 03 1000 - Concrete Forming and Accessories: Forms and accessories for formwork.

B. Section 03 2000 - Concrete Reinforcing.

1.02 REFERENCE STANDARDS

A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials 2010 (Reapproved 2015).

B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete 1991 (Reapproved 2009).

C. ACI 301 - Specifications for Structural Concrete 2016.

D. ACI 302.1R - Guide to Concrete Floor and Slab Construction 2015.

E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete 2000 (Reapproved 2009).

F. ACI 305R - Guide to Hot Weather Concreting 2010.

G. ACI 306R - Guide to Cold Weather Concreting 2016.

H. ACI 308R - Guide to External Curing of Concrete 2016.

I. ACI 318 - Building Code Requirements for Structural Concrete and Commentary 2014 (Errata 2018).

J. ACI 347R - Guide to Formwork for Concrete 2014.

K. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete 2012.

L. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2016, with Editorial Revision (2016).

M. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete 2017a.

N. ASTM C150/C150M - Standard Specification for Portland Cement 2018.

O. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete 2010a (Reapproved 2016).

P. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete 2011.

Q. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete 2017a.

R. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete 2017.

S. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete 2015.

T. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures 2015.

U. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete 2011.

1.03 QUALITY ASSURANCE

A. No payments will be made for extra concrete needed as a result of unauthorized material removed below the required depth found in the field.

B. Perform work of this section in accordance with ACI 301 and ACI 318.

C. Follow recommendations of ACI 305R when concreting during hot weather.

D. Follow recommendations of ACI 306R when concreting during cold weather.

PART 2 PRODUCTS

2.01 FORMWORK

A. Comply with requirements of Section 03 1000.

B. Formwork Design and Construction: Comply with guidelines of ACI 347R to provide formwork that will produce concrete complying with tolerances of ACI 117.

C. Form Materials: Contractor 's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.

1. Form Facing for Exposed Finish Concrete: Contractor 's choice of materials that will provide smooth, stain-free final appearance.

2. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.

D. Formwork Fabrication

1. Fabricate formwork mortartight, braced to prevent displacement under vibration and sagging between supports. For surfaces exposed to view in finished work, use new, clean, smooth plywood free from blemishes, square-cut and in sizes as large as practical.

2. Fabricate forms for removal without hammering or prying against concrete.

3. Provide temporary clean-out openings at base of forms and other locations in formwork to facilitate cleaning and inspection for placing concrete.

2.02 CONCRETE MATERIALS

A. Mixing Water: Drinkable in accordance with ACI 318

B. Cement: ASTM C150/C150M, Type I - Normal.

C. Fine and Coarse Aggregates: ASTM C33/C33M.

D. Lightweight Aggregate: ASTM C330/C330M.

E. Fly Ash: ASTM C618, Class C or F.

F. Calcined Pozzolan: ASTM C618, Class N.

G. Silica Fume: ASTM C1240, proportioned in accordance with ACI 211.1.

H. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.03 ADMIXTURES

A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

B. Air Entrainment Admixture: ASTM C260/C260M.

C. Water Reducing and Accelerating Admixture: ASTM C494/C494M Type E.

D. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.

E. Retarding Admixture: ASTM C494/C494M Type B.

F. Water Reducing Admixture: ASTM C494/C494M Type A.

G. Moisture Vapor Reduction Admixture (MVRA): Liquid, inorganic admixture free of volatile organic compounds (VOCs) and formulated to close capillary systems formed during curing to reduce moisture vapor emission and transmission with no adverse effect on concrete properties or finish flooring.

2.04 ACCESSORY MATERIALS

A. Underslab Vapor Retarder: Sheet material complying with ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. The use of single ply polyethylene is prohibited.

1. Installation: Comply with ASTM E1643.
2. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.
3. Manufacturers:
    a. Fortifiber Building Systems Group; Moistop Ultra 10: www.fortifiber.com/#sle.
    b. Stego Industries, LLC: www.stegoindustries.com/#sle.

B. Cement feathering compound: Ardex “SD-F Feather Finish”, Portland cement-based, latex-modified; or comparable.

C. Perimeter "Zip Strip": Provide a removable bond break "zip strip" capable of producing a clean 1/2" x 1/2" joint to be used for sealing all joints where walls penetrate and abut floor slab. "Sealtight Snap-Cap," W. R. Meadows, 1/2" (12.7mm), or comparable.

D. Porous Fill: Clean, water-worn tailings free from clay, dirt, wood and debris, graded from 2 in. to 3/4 in.

E. Expansion Joint Material: 1/2 inch (12.7mm) asphalt expansion joint filler complying with the following:

1. ASTM D994
2. FS HH-F-341F, Type III
3. AASHTO M33 03300-6
4. FAA Specification P-610-2.7

2.05 CURING MATERIALS

A. Curing and Sealing Compound, Moisture Emission Reducing, Membrane-Forming: Liquid, membrane-forming, clear sealer, for application to newly-placed concrete; capable of providing adequate bond for flooring adhesives, initially and over the long term; with sufficient moisture vapor impermeability to prevent deterioration of flooring adhesives due to moisture emission.

B. Curing Compound, Non-dissipating: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C309.

1. Application: Use at exposed concrete floors.
2. VOC Content: OTC compliant.

2.06 CONCRETE MIX DESIGN

A. Controlled concrete proportioned as outlined in Section 5.3 ACI 318, unless specified otherwise. Allowable design stresses are based on minimum 28-day compressive strength indicated. Submit design mix for each class of concrete for Architect's approval.

B. Proportions of aggregate to cement shall produce non-segregating plastic mixture of consistency required to give specified finish and be worked readily into corners and angles of forms and around reinforcement with method of placement employed. Accomplish variations in consistency by changes in proportioning of mix with changing W/C (water/cement) ratios established.

C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.

1. Admixtures used in concrete: of one manufacturer.

2. Use air-entraining admixture in concrete exposed to elements to obtain air content of 5 percent, plus or minus 1.5 percent for 1-inch maximum aggregate and 6 percent plus or minus 2 percent for 3/4 inch maximum aggregate. Do not premix air-entraining admixture with other admixtures.
3. Retarding densifier: in concrete, except concrete for footings and isolated piers.
4. For low temperature conditions, an accelerating densifier may be used in lieu of a retarding densifier in walls.
5. A water-reducing admixture may be used in lieu of a retarding densifier in slabs.
6. Proportion admixtures in accordance with manufacturer's recommendations.

D. Slump Limits: 3" ± 1"; 4 inch maximum.

2.07 MIXING

A. Ready-mixed ASTM C94, except addition of water for material with insufficient slump shall not be permitted.

B. Provide a certificate signed by authorized official of supplier, with each load of concrete stating the following:

1. Time truck left plant.
2. Mix of concrete.
3. Amount of water and cement in mix.
4. Time truck is unloaded at project site.

C. Retain certificates at project site for inspection by testing laboratory.

D. Not more than one hour shall elapse from time water is introduced into mixer drum until drum is discharged. Do not use concrete that has stood outside the mixer drum for more than 30 minutes. Do not add water to a mix that has stiffened to increase workability. Retempering of partly set concrete is not permitted.

PART 3 EXECUTION

3.01 PREPARATION

A. Prior to placing concrete, clean equipment for transporting concrete. Remove debris and ice from spaces to receive concrete. Oil or wet form, as specified, and clean reinforcement of ice or other coatings. Remove water from areas to receive concrete.

B. Reinforcement, forms and earth in contact with concrete shall be free from frost. Do not place concrete during rainfall without adequate protection. Make preparation to protect newly placed concrete from rainfall until concrete has hardened sufficiently to preclude rainfall damage.

C. Place expansion joint material as indicated for slab isolation at perimeter walls and columns. Depress joint material 1/2 in. below finish slab for installation of “Zip Strip” specified in this section and sealant specified in Section 07900.

D. Formwork:

1. Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.
2. Construct formwork to lines, dimensions, and shapes of concrete indicated, to a tolerance of 1/8 inch in 10 feet. Provide watertight joints in forms. Provide support to maintain tolerance specified during placing of concrete.
3. Coat forms with form release agent prior to each use of form.

4. Secure keys in position by continuous wood blocking rigidly secured to forms or reinforcing.
5. Do not use pinch bars or other metal tools in exposed work to pry forms loose.
6. Use form ties to prevent form deflection, and to prevent spalling of concrete surfaces upon removal of forms.
7. Verify that forms are clean and free of rust before applying release agent.
8. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

3.02 COORDINATION WITH OTHER WORK

A. Provide in locations indicated slots, chases, recesses or openings not formed by sleeves, frames, boxes or equipment specified in other Sections.

B. Examine Contract Documents for work specified in other Sections requiring either building in or provisions for later setting. Set items specified in other Sections and provide protection required to prevent damage or displacement during placing of concrete.

C. Grout and fill with concrete as required throughout the project, except as otherwise specified, and including column base plates, door saddles, frames in concrete walls, and openings after pipes are in place.

D. Minimum 1-inch concrete cover is required over conduits and pipes embedded in concrete. Do not place pipes or conduits having an outside diameter larger than 1/3 slab thickness in slabs.

E. Place conduits and pipes as indicated. Place conduits and pipes to avoid changing location of reinforcing steel.

F. Provide inserts required to bond adjacent construction to concrete.

3.03 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Convey concrete to point of final placement by methods preventing segregation or loss of materials. Place concrete as near as practical in final position to avoid segregation due to handling and flowing. Do not use concrete that has partially hardened, been contaminated by foreign materials or been retempered.

C. Place concrete in layers not exceeding 18 inches in depth avoiding inclined planes and piling and concrete in forms permitting escape of water or free flow of concrete.

D. Place concrete for columns and walls through canvas, wood, rubber or metal elephant trunks, 6 inches in diameter minimum, to avoid segregation of concrete in free fall. Do not allow concrete to ricochet against forms for exposed surfaces. Deposit concrete directly to center of forms. Space drop chutes on 10-foot centers, maximum. Do not use drop chutes longer than 12 feet. Provide illumination to permit inspection of the interior of forms.

E. Vibration:

1. Exposed surfaces shall be finished with a smooth, dense, concrete without honeycombing. Tamp, space, and vibrate concrete thoroughly during placing.
2. Quantity, capacity and type of vibrators used is left to discretion of the Contractor. Maintain a reserve of vibrators in event of breakdown.
3. Exercise care in use of vibrators to prevent scarring or roughening of forms. Vibrators shall not cause separation of free water from mix. Do not vibrate in one spot to extent pools of grout are formed.

4. Do not vibrate to the extent of causing segregation of aggregate. Insert and withdraw vibrators slowly. Vibrators shall run continuously while being withdrawn. Insert unit in a depth to vibrate lower layer of concrete. Do not insert into concrete that is partly hardened or that will not become plastic under vibrator action. Do not apply vibration to steel reinforcing extending into partially hardened concrete.
5. Exercise care to prevent formation of water pockets and bubbles against form faces.

F. Place concrete in continuous operation until panel or section is completed. Locate construction joints at point of minimum shear.

3.04 SLAB JOINTING

A. Locate joints as indicated on drawings.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

D. Contraction Joints at Grade Slabs

1. Contraction joints shall be located as indicated on Drawings or, if not indicated, so as not to impair the strength and appearance of the structure. Joints shall be spaced at a maximum of 20 feet on center, in either direction and shall coincide with column grids, where present. Install contraction joints in accordance with approved joint location shop drawings.
2. Sawcut joints in grade slabs immediately after finishing, and after curing compound has been applied so that the slab surface is not damaged by equipment and sawcutting does not dislodge aggregate. In general, sawcutting of joints shall take place within a period of 7 to 14 hours after concrete is placed, depending on actual project conditions. Sawcutting shall be scheduled to occur within this timeframe to minimize the risk of shrinkage cracking. Work shall not be postponed until the following work day.
3. Contraction joints shall be 1/8 inch wide by a depth equal to 25% of slab thickness.

3.05 CONCRETE FINISHING

A. Finishes other than floors:

1. After removal of forms, remove fins and forms marks by grinding on exposed interior and exterior surfaces scheduled to receive paint or membrane waterproofing. Patch voids and honeycombs.
2. Interior and exterior exposed concrete surfaces: "Rubbed Finish." Apply grout, clean-down after the patching, grinding, and cleaning operations are complete. The grout wash shall follow the patching operation as soon as possible and the procedure shall be as follows:
    a. Mix one part portland cement and 1-1/2 parts fine sand with sufficient water to produce a grout having the consistency of thick paint. Use white portland cement for cement in grout. Wet the surface of the concrete sufficiently to prevent absorption of water from grout and apply grout with a brush or burlap completely filling air bubbles and holes. Immediately after applying grout, float surface with a cork or other suitable float, scouring vigorously. While the grout is still plastic, finish surface with a sponge rubber float, removing excess grout.
    b. Finishing shall be done at time when grout will not pull from holes of depressions. Next, allow surface to dry until surface takes on a powdery appearance, then rub vigorously with dry burlap to remove completely dried grout. No visible film or grout shall remain after rubbing. Complete entire cleaning operation for an area the day it is started. Do not leave grout on overnight.

c. After the concrete has been grout-cleaned, if slightly dark spots or streaks remain, wipe off lightly with a fine abrasive hone without using water. Rubbing with the hone shall not be sufficient to change the texture of the concrete. Include final operation as part of grout cleaning where necessary.

3. In foundation walls below grade and both sides of pit walls, cut back ties and spreaders to a depth of approximately 1-1/2 in. Cut back honeycombed concrete and voids to sound concrete. Cuts shall be to depth of at least 1-1/2 in. with edges perpendicular to surface.

4. Concrete surfaces not exposed to view may be left "as is." Fill holes resulting from cutting back of scale pockets, honeycomb, surface voids and the removal of form wires or spreaders with cement mortar.

B. Floor and slab finishes:

1. Measure floor finish tolerances in accordance with ASTM E1155. Individual floor sections shall be bounded by construction joints, contraction (control) joints, or column lines that form the smallest sections.

2. Floor Slab Tolerance: After final troweling operation slab shall have a surface place tolerance not exceeding 1/4 inch in 10 feet when tested with a loft straightedge, but 1/4 inch shall not be cumulative.

3. Where specified tolerances in surface elevation of slabs are exceeded, grind or patch the surface to obtain specified tolerance. Grind as soon as possible but not before 3 days of cure. Install patching material in accordance with manufacturer's instructions.

4. Finishes:

a. Scratched finish for surfaces to receive bonded applied cementitious finishes: After the surface has been struck off, consolidated and leveled, roughen surface with stiff brushes or rakes before final set.

b. Troweled finish for surface to receive finish flooring or be exposed: Float finish surfaces first and then apply power-driven trowel and then hand trowel. First troweling after power floating shall be with a power trowel producing a smooth surface relatively free of defects. Additional troweling by hand after surface has hardened sufficiently to produce a ringing sound as the trowel is moved over the surface. Thoroughly consolidate surface by hand trowel operation. Finished surface shall be free of trowel markings and be uniform in texture and appearance. On surfaces receiving floor coverings, remove defects of sufficient magnitude to show through floor covering by grinding.

c. Broom finish: Light/medium broom on ramps and sidewalks, to be approved in field by Architect, finish to be consistent.

5. Floor Slab Recesses and Slopes:

a. Where floor drains are indicated on Drawings, slope floor slabs to drain.

3.06 FORMS REMOVAL

A. Forms not supporting weight of concrete, such as sides of beams, walls, columns, and similar work, may be removed after cumulatively curing at not less than 50o F. for at least 24 hours after placing concrete, provided that concrete is sufficiently hard so as not to be damaged by form removal, and provided that curing and protection measures are maintained.

B. Forms supporting the weight of concrete shall not be removed in less than 14 days or until the concrete has attained at least 70% of the design strength.

3.07 CURING AND PROTECTION

A. Curing:

1. Spray top surface of slabs with liquid membrane-forming compound in accordance with manufacturer's directions as soon as the newly placed surface has been finished and will not be marred by application.
2. Respray surfaces subjected to heavy rainfall within three hours of compound application.
3. Where practicable, keep forms in place for a seven-day curing period. Keep top exposed concrete surface wet and forms moist. Loosen forms to allow curing water to run down between concrete and forms.
4. If forms cannot remain in place for seven days, cover concrete with fabrics that have moisture-retaining properties. Examine fabrics to detect elements that might discolor concrete finish. Keep fabric moist continuously to ensure a film of water on concrete surface.

B. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

C. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

D. Cold Weather Protection

1. Protection of concrete during cold weather shall comply with ACI 306; heating of concrete shall be in accordance with ASTM C94-78. Cold weather techniques shall be used where the mean daily temperature falls below 40 degrees F for at least two (2) consecutive days.
2. Temperature of the concrete at time of placement shall not be less than 50 degrees F. Temperature of the soil against which concrete to be placed shall not be less than 40 degrees F.
3. Concrete temperature shall be maintained at a minimum of 50 degrees F for at least seventy-two (72) hours after placement.
4. Contractor shall provide to the architect a description of cold weather protection procedures to be used, including the methods for determining the need for the procedures.

E. Hot Weather Protection

1. Protection of concrete during hot weather shall comply with ACI 301 and ACI 305. Hot weather protection procedures shall be used when the temperature of the concrete mix exceeds 85 degrees F.
2. Temperature of the concrete mix may exceed 85 degrees F only if water reducing and retarding compound complying with ASTM C494 is used.
3. Hot weather precautions shall be instituted by the contractor when the anticipated rate of evaporation, as determined by guidelines in ACI 305, is expected to reach 0.2 pounds per square foot per hour (lb/sq. ft./hr.).
4. The contractor shall provide to the architect a description of hot weather protection procedures to be used, including the methods for determining when the procedures will need to be implemented. Provide written recommendations from the manufacturer for use of water reducing and retarding compounds.

3.08 FIELD QUALITY CONTROL

A. Concrete shall be sampled and tested for quality control during the placement of concrete as follows:

1. Sampling Fresh Concrete: ASTM C172, except modified for slump to comply with ASTM C94.

2. Slump: ASTM C143; one test for each concrete load at point of discharge, and one for each set of compressive strength test specimens. The testing laboratory or Owner's Representative shall have the authority to reject any concrete that does not have the specified slump.
3. Air Content: ASTM C231, pressure method; one for each set of compressive strength test specimens.

B. Compression Test Specimens

1. ASTM C31: One set of 5 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.
2. Tests shall be made by an independent testing laboratory. Not less than one test for each 150 cubic yards of concrete, or fraction thereof, or each 5,000 sq. ft. of slab, for each class of concrete placed will be required, and in any event not less than one test for each day's pour of each class of concrete. Four specimens will be made for each test: ASTM C39 and C31.
3. Standard age of test shall be 28 days. Seven-day test results shall be reported to Architect for two cylinders of each class of concrete. Test 2 cylinders at 28 days and 2 at 7 days.
4. If strength of laboratory control cylinders for any portion of structure falls below the compressive strength required for the design, Architect shall have the right to order change in proportions of water content of concrete for remaining portions of structure. In addition, where there is question as to quality of concrete in structure, Architect may require tests in accordance with ASTM C42. Should such tests fail to develop minimum strengths specified, faulty concrete shall be replaced.
5. Report test results in writing to the Architect and the Contractor on the same day that tests are made. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of Contractor, name of concrete supplier and truck number, name of concrete testing service, concrete type and class, location of concrete batch in the structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength and type of break for both 7-day and 28-day tests. Furnish copy of each test to local building inspections office at same time other submittals are made.
6. Contractor must provide a concrete cylinder storage box acceptable to the testing and inspection laboratory.

C. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.

3.09 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.

B. Repair or replacement of defective concrete will be determined by the Architect . The cost of additional testing shall be borne by Contractor when defective concrete is identified.

3.10 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION

SECTION 03 3511
CONCRETE FLOOR FINISHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface treatments for concrete floors and slabs.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.

B. Section 03 3000 - Cast-in-Place Concrete: Curing compounds that also function as sealers.

C. Section 03 3523 - Exposed Aggregate Concrete Finishing.

D. Section 09 6623 - Resinous Matrix Terrazzo Flooring.

E. Section 09 9600 - High-Performance Coatings.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with concrete floor placement and concrete floor curing.

1.04 SUBMITTALS

A. Quality Assurance:

1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties as cited in 1.03 Performance Requirements.

2. Certificates:

a. Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

b. Letter of certification from the National Floor Safety Institute confirming the system has been tested and passed phase Two Level of certification when tested by Method 101-A.

c. Current contractor’s certificate signed by manufacturer declaring contractor as an approved installer of polishing system.

3. Manufacturer’s Instructions: Manufacturer’s installation instructions.

B. CLOSEOUT SUBMITTALS

1. Warranty: Submit warranty documents specified.

2. Operation and Maintenance Data: Submit operation and maintenance data for installed products to include:

a. Manufacturer’s instructions on maintenance renewal of applied treatments.

b. Protocols and product specifications for joint filing, crack repair and/or surface repair.

C. See Section 01 3000 - Administrative Requirements, for submittal procedures.

D. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.

E. Maintenance Data: Provide data on maintenance and renewal of applied finishes.

1.05 QUALITY ASSURANCE

A. Qualifications:

1. Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
2. Installer trained and holding current certification for FGS PermaShine installation.
3. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction and approving application method.

B. Regulatory Requirements.

1. NFSI Test Method 101-A Phase Two Level High Traction Material.

C. Mock-Ups:

1. Mock-Up Size: 100 ft2 sample panel at jobsite at location as directed under conditions similar to those which will exist during actual placement.
2. Mock-up will be used to judge workmanship, concrete substrate preparation, operation of equipment, material application, color selection and shine.
3. Allow 24 hours for inspection of mock-up before proceeding with work.
4. When accepted, mock-up will demonstrate minimum standard of quality required for this work.
5. Approved mock-up may remain as part of finished work.

D. Preinstallation Meetings: Conduct a preinstallation meeting to verify project requirements, manufacturer’s installation instructions and manufacturer’s warranty requirements. Review the following:

1. Environmental requirements.
2. Scheduling and phasing of work.

1.06 MOCK-UP

1. Coordinating with other work and personnel.
2. Protection of adjacent surfaces.
3. Surface preparation.
4. Repair of defects and defective work prior to installation.
5. Cleaning.
6. Installation of polished floor finishes.
7. Application of liquid hardener, densifier.
8. Protection of finished surfaces after installation.

B. Mock-Up Size: 100 ft2 sample panel at jobsite at location as directed under conditions similar to those which will exist during actual placement.

C. Mock-up will be used to judge workmanship, concrete substrate preparation, operation of equipment, material application, color selection and shine.

D. Allow 24 hours for inspection of mock-up before proceeding with work.

E. When accepted, mock-up will demonstrate minimum standard of quality required for this work.

F. Approved mock-up may remain as part of finished work.

G. For coatings, construct mock-up area under conditions similar to those that will exist during application, with coatings applied.

H. Mock-Up Size: 10 feet (3 m) square.

I. Locate where directed.

J. Mock-up may remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's sealed packaging, including application instructions.

B. Ordering: Comply with manufacturer’s ordering instructions and lead time requirements to avoid construction delays.

C. Delivery:

1. Deliver materials in manufacturer’s original packaging with identification labels and seals intact.

D. Storage and Protection:

1. Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.

2. Protect concrete slab.

a. Protect from petroleum stains during construction.

b. Diaper hydraulic power equipment.

c. Restrict vehicular parking.

d. Restrict use of pipe cutting machinery.

e. Restrict placement of reinforcing steel on slab.

f. Restrict use of acids or acidic detergents on slab.

3. Waste Management and Disposal:

a. Remove from site and legally dispose of packaging materials.

1.08 FIELD CONDITIONS

A. Installation Location: Comply with manufacturer’s written recommendations.

B. Maintain light level equivalent to a minimum 200 W light source at 8 feet (2.5 m) above the floor surface over each 20 foot (6 m) square area of floor being finished.

C. Do not finish floors until interior heating system is operational.

D. Maintain ambient temperature of 50 degrees F (10 degrees C) minimum.

1.09 SEQUENCING

A. Sequence With Other Work: Comply with manufacturer’s written recommendations for sequencing construction operations.

1.10 WARRANTY

A. Manufacturer’s Warranty: Submit, for Owner’s acceptance, manufacturer’s standard warranty document executed by authorized company official. Manufacturer’s warranty is in addition to, and does not limit, other rights Owner may have under Contract Documents.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Ensure manufacturer has minimum 5 years experience in manufacturing components similar to or exceeding requirements of project.

B. Polished Concrete Finishing Products

1. Manufacturer: L & M Construction Chemicals, Inc. is the design basis of this specification. Other manufacturers may be proposed no later than ten days prior to bid date in accordance with Section 01630.

C. Products/Systems:

1. Hardener, Sealer, Densifier: Proprietary, water based, odorless liquid, VOC compliant, environmentally safe chemical hardening solution leaving no surface film.
    a. Acceptable Material: L & M Construction Chemicals, Inc., FGS Hardener Plus.
2. Joint Filler: Semi-rigid, 2-component, self-leveling, 100% solids, rapid curing, polyurea control joint and crack filler with Shore A 80 or higher hardness.
    a. Acceptable Material: L & M Construction Chemicals, Inc., Joint Tite 750.
3. Oil Repellent Sealer: Ready to use, silane, siloxane and fluoropolymers blended water based solution sealer, quick drying, low-odor, oil and water repellent, VOC compliant and compatible with chemically hardened floors.
    a. Acceptable Material: L & M Construction Chemicals, Inc., Petrotex.
4. Concrete Dyes: Fast-drying dye, packaged in premeasured units ready for mixing with VOC exempt solvent; formulated for application to polished cementitious surfaces.
    a. Acceptable Material: L & M Construction Chemicals, Inc., Vivid Concrete Dyes.
5. Cleaning Solution: Proprietary, mild, highly concentrated liquid concrete cleaner and conditioner containing wetting and emulsifying agents; biodegradable, environmentally safe and certified High Traction by National Floor Safety Institute (NFSI).
    a. Acceptable Material: L & M Construction Chemicals, Inc., FGS Concrete Conditioner.
6. Finish: Standard High gloss (HG-1), 1500 grit
7. Color: As selected by Owner/Architect from standard palette of 24 colors.

D. SOURCE QUALITY CONTROL

1. Ensure concrete finishing components and materials are from single manufacturer.

2.02 CONCRETE FLOOR FINISH APPLICATIONS

A. Unless otherwise indicated, all concrete floors are to be finished using liquid densifier/hardener.

B. Liquid Densifier/Hardener:

C. Penetrating Clear Sealer:

D. High Gloss Clear Sealer:

E. Slip Resistant Coating: High gloss clear sealer with plastic aggregate.

F. Polished Finish:

2.03 SURFACE TREATMENTS

A. Troweling Aid, Densifier and Curing Agent: Liquid reactive colloidal silica-based topical treatment, spray-applied to wet concrete and floated or troweled into the surface.

2.04 DENSIFIERS AND HARDENERS

A. Liquid Densifier/Hardener: Penetrating chemical compound that reacts with concrete, filling the pores and dustproofing; for application to concrete after set.

1. Composition: Lithium silicate.

2.05 COATINGS

A. High Gloss Clear Coating: Transparent, non-yellowing, water- or solvent-based coating.

1. Composition: Acrylic polymer-based.

2. Nonvolatile Content: 15 percent, minimum, when measured by volume.

B. Low Gloss Clear Coating: Transparent, non-yellowing, water- or solvent-based coating.

1. Composition: Acrylic polymer-based.

2. Nonvolatile Content: 25 percent, minimum, when measured by volume.

C. Penetrating Sealer: Transparent, non-yellowing, water- or solvent-based coating.

1. Composition: Siliconate.

D. Plastic Aggregate: Finely ground polymer for addition to coatings for slip resistance.

2.06 POLISHED CONCRETE SYSTEM

A. Polished Concrete System: Materials, equipment, and procedures designed and furnished by a single manufacturer to produce dense polished concrete of the specified sheen.

1. Acceptable Systems:

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that floor surfaces are acceptable to receive the work of this section.

B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

3.02 GENERAL

A. Apply materials in accordance with manufacturer's instructions.

3.03 MANUFACTURERS INSTRUCTIONS

A. Compliance: Comply with manufacturer’s written data, including product technical bulletins, product catalog installation instructions, product carton installation instructions and L & M Construction Chemicals, Inc., SPEC-DATA sheets.

B. Use only L & M certified FGS/PermaShine installers.

3.04 EXAMINATION

A. Site Verification of Conditions:

1. Verify that concrete substrate conditions, which have been previously installed under other sections or contracts, are acceptable for product installation in accordance with manufacturer’s instructions prior to installation of concrete finishing materials.

3.05 PREPARATION

A. Ensure surfaces are clean and free of dirt and other foreign matter harmful to performance of concrete finishing materials.

B. Examine surface to determine soundness of concrete for polishing.

C. General Contractor to remove surface contamination.

3.06 INSTALLATION

A. Floor Surface Polishing and Treatment:

1. Provide polished concrete floor treatment in entirety of slab indicated by drawings. Provide consistent finish in all contiguous areas.
2. Apply floor finish prior to installation of fixtures and accessories.
3. Diamond polish concrete floor surfaces with power disc machine recommended by floor finish manufacturer. Sequence with coarse to fine grit using dry method.
    a. Comply with manufacturer's recommended polishing grits for each sequence to achieve desired finish level. Level of sheen shall match that of approved mock-up.
    b. Expose aggregate in concrete surface only as determined by approved mock-up.
    c. All concrete surfaces shall be as uniform in appearance as possible.
4. Dyed and Polished Concrete:
    a. Locate demarcation line between dyed surfaces and other finishes.
    b. Polish concrete to final finish level.
    c. Apply diluted dyes to polished concrete surface.
    d. Allow dye to dry.
    e. Remove residue with dry buffer; reapply as necessary for desired result.
5. Apply FGS Hardener Plus, Hardener, Densifier As Follows:
    a. First coat at 250 ft2 /gal (6.25 m2 /L).
    b. Second coat at 350 ft2 /gal (8.75 m2 /L).
    c. Follow manufacturer's recommendations for drying time between successive coats.
6. Remove defects and repolish defective areas.
7. Finish edges of floor finish adjoining other materials in a clean and sharp manner.

3.07 ADJUSTMENTS

A. Polish to higher gloss those areas not meeting specified gloss levels per mockup.

B. Fill joints flush to surface.

3.08 FINAL CLEANING

A. Mechanically scrub treated floors for seven days with soft to medium pads with approved cleaning solution.

B. Upon completion, General Contractor must remove surplus and excess materials, rubbish, tools and equipment.

3.09 COATING APPLICATION

A. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.

B. Verify that water vapor emission from concrete and relative humidity in concrete are within limits established by coating manufacturer.

C. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.

3.10 CONCRETE POLISHING

A. Execute using materials, equipment, and procedures specified by manufacturer, using manufacturer approved installer.
   1. Final Polished Sheen: Satin finish; other sheens are included as comparison to illustrate required sheen; final sheen is before addition of any sealer or coating, regardless of whether that is also specified or not.
   2. Satin Finish: Reflecting images from side lighting.

B. Protect finished surface as required and as recommended by manufacturer of polishing system.

END OF SECTION

SECTION 03 3533
STAMPED CONCRETE FINISHING

PART 1 – GENERAL

1.01 GENERAL

A. SECTION INCLUDES:

1. Colored and color-hardened concrete paving with imprinted pattern Portland and cement stain/sealer treatments.

1.02 RELATED DOCUMENTS

A. Section 07 9000 - Joint Sealants: Sealant for joints.

1.03 REFERENCES

A. American Concrete Institute (ACI)

B. ACI 305R - Hot Weather Concreting.

C. ACI 306R - Cold Weather Concreting.

D. ACI 308 - Standard Practice for Curing Concrete.

E. ACI 309 - Standard Practice for Consolidation of Concrete.

F. ACI 347 - Guide to Formwork for Concrete.

G. ACI 503 - Standard Specification for Bonding Plastic Concrete to Hardened Concrete with a Multi-Component Epoxy Adhesive.

H. American Society for Testing and Materials (ASTM)

I. ASTM C33 - Standard Specifications for Concrete Aggregates.

J. ASTM C150 - Standard Specifications for Portland Cement.

K. ASTM C260 - Standard Specifications for Air-Entraining Admixtures for Concrete.

L. ASTM C309 - Standard Specifications for Liquid Membrane Forming Compounds for Curing Concrete.

M. ASTM C494 - Standard Specifications for Chemical Admixtures for Concrete.

1.04 SUBMITTALS

A. Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

B. Testing:

1. Submit proposed mix design for each class of concrete for review prior to commencement of work.
2. Testing firm will take cylinders and perform slump and air entrainment tests in accordance with ACI 301.
3. Four concrete test cylinders will be taken for each class of concrete placed each day.
4. One slump test will be taken for each set of test cylinders taken.

1.05 QUALITY ASSURANCE

A. Installer Qualifications:

1. The Installer shall provide a qualified foreman or supervisor who has a minimum of three years experience with imprinted and textured concrete, and who has successfully completed at least five imprinted concrete installations of high quality and similar in scope to that required.
2. The concrete is cast in place, on the job site, by trained and experienced workmen who shall be employed by a firm that is a licensed and certified Imprint Licensed Contractor by a reputable national colored concrete company.
3. Perform work in accordance with ACI 301, 302, 303.
4. Obtain materials from same source throughout.
5. Conform to applicable codes and regulations for paving work performed within the public right of way.

B. Ready-Mixed Supplier Qualifications:

1. Supplier of ready-mixed concrete products shall comply with ASTM C 94 requirements for production facilities and equipment. Supplier shall be certified according to NCRMA's "Certification of Ready Mixed Concrete Production Facilities Quality Control Manuals."

C. Testing Agency Qualifications:

1. An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

D. Mock-Up:

1. Provide field samples of surface colors textures and patterns specified for architect approval prior to beginning work, 48 inches by 48 inches in size illustrating paving finishes.
   a. Finish areas designated by Architect.
   b. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect
   c. Finish mock-up area as required to produce acceptable work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 PROJECT CONDITIONS

A. Do not place pavement when base surface or ambient temperature is less than 40 degrees F (4 degrees C) or if base surface is wet or frozen.

B. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.08 WARRANTY

A. All materials equal to that manufactured by The Bomanite Company and warranted to be of uniform quality within manufacturing tolerances.

PART 2 - PRODUCTS

2.01 SYSTEM

A. Supporting Structure:

1. Mix Design:
    a. Mix and deliver concrete in accordance with ASTM C94, Alternate 2. Refer to Drawings for concrete strength requirements.
    b. Use accelerating admixtures containing no calcium chloride in cold weather only when approved by testing laboratory. Use of admixtures will not relax cold weather placement requirements.
    c. Use set retarding admixtures during hot weather only when approved by testing laboratory.
    d. Add air entraining agent to concrete mix for concrete work exposed to exterior, in amounts of 4 to 7 percent of total concrete volume or as otherwise recommended by testing laboratory.
    e. Add coloring admixture where scheduled in quantities recommended by coloring admixture manufacturer to achieve selected color.
    f. Maintain water cement ratio to produce a minimum of 3 to maximum of 5 inch slump.
    g. Use of calcium chloride is strictly prohibited.
2. Subgrade:
    a. Refer to drawings for scope of subgrade preparation.
3. Color:
    a. Integral Color: to be selected from Manufacturer’s standard color chart.
        1) Integral Coloring Admixture: Integral Color, synthetic oxide pigment, meeting ASTM C979 and C494.
            (a) Type A, cement dispersing/water reducing.
            (b) Type D, set retarding/water reducing.
            (c) Color to be confirmed by Owner/Architect.
    b. Color Hardener:
        1) Bomanite Color Hardener: The concrete shall be colored with Color Hardener. Color to be selected from Manufacturer's standard color chart.
4. Tools Selection:
    a. Imprinting Tools:
        1) Mat type imprinting tools for texturing freshly placed concrete, in pattern/texture as selected by Architect or as scheduled.
        2) Imprinting tools for specialty projects shall become property of the City of Tulsa after the project.
    b. Textures and Patterns:
        1) Designs as scheduled. Refer to Drawings.
5. Release Agent Selection:
    a. Powdered Release Agent. Up to two (2) colors to be selected.
    b. Permapro Gunsmoke Release Agent or equal.
    c. Liquid Release Agent. Clear color
    d. Bomanite Liquid Release or equal.
6. Secondary Antique or Coloration:

a. Topical Stain:

1) Colors to be selected from Manufacturer's standard color chart.

b. Chemical Stain:

1) Colors to be selected from Manufacturer's standard color chart.

7. Cure Agent:

a. Membrane Color Cure:

1) Color(s) as scheduled. Refer to Drawings.

(a) Curing Compound: Meeting ASTM C309, water based emulsion.

2) Silicate Cure & Densifier.

2.02 RELATED MATERIALS

A. Cement:

1. ASTM C150, type 1, Portland cement, gray color.

B. Fine and Coarse Aggregates:

1. ASTM C33.

C. Water:

1. Clean and not detrimental to concrete.

D. Form Material:

1. Conform to ACI 301. If using metal, material shall be free from deformities. If using wood, use construction grade lumber, sound and free of warp, minimum 2 inches (51 mm) nominal thickness, except where short radii of curves require thinner forms.

E. Contraction Joint Devices:

1. Galvanized sheet metal, keyed profile.

F. Tie Wire:

1. Annealed steel, minimum 16 gage size.

G. Dowels:

1. ASTM A615; Grade 40, plain steel, uncoated finish.

H. Form release agent:

1. As acceptable to concrete colorant manufacturer, non-staining, dissipative type.

I. Vapor Retarding Membrane:

1. 10 mil (.2540 mm) reinforced polyethylene.

J. Air-Entraining Admixture:

1. ASTM C 206. Air Entrained Concrete shall be used wherever concrete is exposed to the freezing weather. Proportions of entrained air, as determined by ASTM C233, and C260, shall be as follows:

a. Aggregate: 3/8 inch maximum size aggregate 6-8 percent entrained air.

b. Aggregate: 3/4 inch maximum size aggregate 5-7 percent entrained air

K. Joint Fillers:

1. Asphaltic Joint Filler:

a. Asphalt impregnated fiberboard, ASTM D1751, 1/2 inch (12 mm) thick.

2. Non-Asphaltic Joint Fillers:

a. ASTM D1752, Type I

L. Sealants:

1. Two part polyurethane sealants, of grade as required to suit application, meeting ASTM C920, in manufacturer's custom colors.

a. Urethane, SL grade, as specified in Section 07 9000.

b. Urethane, SL-TB grade as specified in Section 07 9000.

M. Bonding-Agent:

1. ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene rubber.

N. Epoxy-Bonding Adhesive:

1. ASTM C 881, two component epoxy resin, capable of humid curing and bonding to damp surface, of class and grade to suit requirements if required, and as follows: Types I and II, non-load bearing, for bonding hardened of freshly mixed concrete to hardened concrete.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify compacted subgrade is ready to support paving and imposed loads, free of frost, smooth and properly compacted.

B. Verify gradients and elevations of base are correct, and proper drainage has been provided so water does not stand in the area to receive paving.

C. Beginning of installation means acceptance of existing conditions.

3.02 PREPARATION

A. If vapor retarding membrane is not used, moisten base to minimize absorption of water from fresh concrete.

B. Notify Architect and testing laboratory, minimum 24 hours prior to commencement of concreting operations.

3.03 FORMING

A. Construct and remove forms in accordance with ACI 347.

B. Place and secure forms to correct location, dimension, and profile. Adequately brace to withstand loads applied during concrete placement.

C. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

D. Place joint fillers vertical in position, in straight lines. Secure to formwork during concrete placement.

3.04 INSERTS AND ACCESSORIES

A. Make provisions for installation of inserts, accessories, anchors, and sleeves

B. Place vapor retarder continuously over subgrade. Overlap joints a minimum of 12 inches (305 mm) and seal with a joint tape of same permeance as sheeting material.

3.05 JOINTS

A. Intentional stoppage of concrete placing shall be at planned location of either an expansion joint or contraction joint.

B. When stoppage occurs at an expansion joint, install joint assembly with a bulkhead of sufficient section drilled to accommodate required dowels. Provide expansion joints at maximum 50 feet (15 m) o.c.e.w. at pedestrian paving. Align joints with stamped concrete pattern.

C. When stoppage occurs at a contraction joint, install sheet metal joint assembly of sufficient section to prevent deflection, shaped to concrete section.

D. Stoppage at Unintentional Location:

1. Immediately upon unintended stoppage of concrete placing, place available concrete to a line and install bulkhead perpendicular to surface of pavement and at required elevation. Place and finish concrete to this bulkhead.
2. Remove and dispose of concrete remaining on subgrade ahead of bulkhead.
3. When placing of concrete is resumed before concrete has set to extent that concrete will stand on removal of bulkhead, new concrete shall be rodded with the first; otherwise, carefully preserve joint face.
4. Provide a joint seal space at edges created by a construction joint of this type shall have a joint seal space as detailed on Drawings.

E. Provide sawed contraction joints in pedestrian paving spaced 10 feet o.c.e.w. spacing. Align joints with stamped concrete pattern.

1. Saw joints after completion of finishing operations as soon as concrete has hardened to extent necessary to prevent revealing of joint or damage to adjacent concrete surfaces.
2. Saw joints same day that concrete is placed except that sawing of joints in concrete placed late in day may be delayed until morning of following day.
3. In any event, saw joints within 18 hours after placing concrete.
4. Use a power-driven concrete saw made especially for sawing concrete and maintain in good operating condition.
5. Saw cut shall be to a depth equal to 1/4 of slab thickness, minimum one inch (25 mm) depth.
6. Align joints in vehicular paving with joints in adjacent pedestrian paving.
7. Cut joints through curbs at right angles to back of curb.

F. Place joint filler between paving components and building or other appurtenances.

G. Provide scored joints in sidewalks and plazas to a depth of 1/4 the slab thickness, and at intervals as indicated, but in no case spaced greater than width of walk.

3.06 PLACING CONCRETE

A. Consolidate concrete by suitable means to prevent formation of voids or honeycombs. Exercise care to prevent disturbance of forms and damage to vapor retarder. Place concrete to lines and levels shown, properly sloped to drain as designed.

1. Hot Weather Placement: ACI 305.
2. Cold Weather Placement: ACI 306.
3. Ensure inserts, embedded parts, and formed joints are not disturbed during concrete placement.
4. Place concrete continuously between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

B. After consolidating and screeding, float concrete to gradients indicated. Use a straight edge to level and test surface in longitudinal direction to required grade. Finish edges to provide a smooth dense surface

with 1/8 inch (3 mm) radius.

C. Apply Color Hardener prior to application of pattern. Apply at rate recommended by manufacturer, evenly to the surface of the fresh concrete by the dry-shake method. Applied in two or more shakes, floated after each shake and troweled only after the final floating.

D. While concrete is still in its plastic state, apply the tool/texture pattern to the surface of the concrete. Properly tamp tools into the surface to achieve the required texture, with uniformity of pattern and depth of stamping. Utilize bond breaker to keep tools from sticking to fresh concrete.

1. Release material shall be applied to the troweled surface prior to imprinting.

E. Place curing compound on exposed concrete surfaces immediately after finishing.

F. Apply in accordance with manufacturer's instructions.

G. Apply secondary stain treatment per approved mock-up or as scheduled to achieve design.

H. Apply finish sealer per approved mock-up or as specified to achieve design required.

3.07 FIELD QUALITY CONTROL

A. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.08 PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessive hot or cold temperatures, and mechanical injury.

3.09 METHOD OF MEASUREMENT

A. Stamped Concrete Paving. The quantity to be measured for under this item shall be for each logo installed at the location and of the type shown on the Plans or in the Proposal, completed and accepted, measured in place.

END OF SECTION

SECTION 03 3713
SHOTCRETE

PART 1 GENERAL

1.01 SUMMARY

A. Related Documents:

1. Drawings and general provisions of the Subcontract apply to this Section.
2. Review these documents for coordination with additional requirements and information that apply to work under this Section.

B. Section Includes: Pneumatically applied concrete.

C. Related Sections:

1. Division 01 Section "General Requirements."
2. Division 01 Section "Special Procedures."
3. Division 03 Section "Concrete".
4. Division 03 Section "Concrete Reinforcing".
5. Division 03 Section "Cast-in-Place Concrete".

1.02 REFERENCES

A. General:

1. The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.
2. Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.
3. Refer to Division 01 Section "General Requirements" for the list of applicable regulatory requirements.

B. ACI – American Concrete Institute:

1. Guide to Shotcrete
2. Specifications for Shotcrete

C. ASTM International:

1. Standard Specification for Concrete Aggregates
2. Standard Specification for Portland Cement
3. Standard Practice for Preparing and Testing Specimens from Shotcrete Test Panels
4. Standard Specification for Admixtures for Shotcrete

1.03 SUBMITTALS

A. Submit under provisions of Division 01 Section "General Requirements."

B. Qualifications of shotcrete applicator and personnel performing the work.

C. Mix designs including compressive test data used to establish proportions. Material certificates for shotcrete materials, including cements, aggregates and admixtures. Submit to Testing Laboratory for record purposes.

D. Submit batch tickets to Testing Laboratory for each batch of shotcrete, indicating weight of cement, aggregate, water and admixtures.

E. Samples as requested by the Testing Laboratory or University.

1.04 QUALITY ASSURANCE

A. Perform shotcrete work in accordance with the requirements of ACI 506.2, "Specifications for Materials, Proportioning, and Application of Shotcrete," and [Section 1924 of the California Building Code].

B. Shotcrete Mix Design: Testing laboratory shall, under direction of its California registered Civil Engineer, design shotcrete mixes. Each mix shall bear the signature and registration number of the responsible engineer.

C. Test Panels: Prepare preconstruction test panels at least 21 days prior to job placement, using the mix and equipment proposed for the project.

1. Each proposed nozzleman shall prepare a panel demonstrating each shooting orientation.
2. Fabricate test panels in accordance with ASTM C1140 and CBC 1924.5 and as approved by the University's Representative.
3. Notify Testing Laboratory to observe placement of panels. Maintain panels at point of fabrication for 7 days and until Testing Laboratory has taken cores.
4. Samples taken from test panel shall achieve a mean core grade of 2.0, in accordance with Section 1.7 of ACI 506.2, "Shotcrete Core Grades". In the event of failure, nozzleman shall be permitted one retest. Any nozzleman failing the second test shall not be permitted on the project.

D. Certificates of Compliance: Acceptability of the following materials will be based upon documentation furnished by the manufacturer identifying each batch of material and certifying compliance with the requirements specified.

1. Portland cement
2. Fly Ash
3. Admixtures

E. Certified laboratory test reports: Before delivery of materials, certified copies of the reports of all tests required in referenced publications or otherwise specified here shall be submitted. Certified test reports are required for the following:

1. Cement
2. Aggregates
3. Admixtures

1.05 ENVIRONMENTAL REQUIREMENTS

A. Ensure materials and surrounding air temperature are a minimum 40 deg F (4.4 deg C) prior to, during, and seven days after completion of work.

B. During freezing or near freezing weather, provide equipment and cover to maintain minimum 40 deg F (4.4 deg C) and to protect work completed or work in progress.

C. Suspend shotcrete operations during high winds, rainy weather, hot weather, or near freezing temperatures when work cannot be protected.

PART 2 PRODUCTS

2.01 MATERIALS

A. Concrete materials shall conform to the appropriate requirements of Section [Division 03 Section "Concrete Reinforcing"] Division 03 Section "Cast-in-Place Concrete"], ACI 506R and ACI 506.2 except as specified herein for adjustment of aggregate and mix for placing.

B. Addmixtures: ASTM C1141.

C. Aggregate: ASTM C33, combined Gradation No. 2 as specified in ACI 506.R.

2.02 SHOTCRETE MIX

A. Proportion shotcrete mix in accordance with ACI 506.2.to achieve 4,000 psi (27.6 MPa) compressive strength at 28 days.

B. Provide a mix that is plastic enough to give good compaction and low percentage of rebound, but stiff enough not to sag.

C. Measure and mix shotcrete in accordance with requirements of [Division 03 Section "Concrete Reinforcing"] Division 03 Section "Cast-in-Place Concrete"].

2.03 EQUIPMENT

A. Equipment: Equipment of design and size which has given good results in similar work; pneumatic feed type; capable of maintaining continuous placement.

B. Air Supply: Clean, dry air adequate for maintaining sufficient nozzle velocity, uniformly steady for work while simultaneously operating blow pipe for cleaning away rebound.

C. Delivery Equipment: Capable of discharging aggregate-cement-water mixture accurately, uniformly, and continuously through the delivery hose.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Verify fabricated forms are true to line and dimension, adequately braced against deflection and vibration, and constructed to permit escape of air and rebound during gunning operations.

C. Ensure correct placement of reinforcement. Ensure sufficient clearance around reinforcement to permit complete encasement.

D. Ensure easy access to shotcrete surfaces for screening and finishing, to permit uninterrupted application.

E. Beginning of installation means the Subcontractor accepts that the existing conditions meet the above criteria.

3.02 PREPARATION

A. Prepare smooth, even surfaces. Minimize abrupt changes in thickness of repair. Remove square external corners from substrate by radiating the edge.

B. Ensure that forms are true to line and dimension, adequately braced against deflection and vibration, and constructed to permit escape of air and rebound during gunning operations.

C. Do not place shotcrete on any surface which is frozen, spongy or where there is standing water.

D. Shotcrete placed against existing concrete or masonry - Remove unsound material before applying shotcrete. Chip or scarify any area to be repaired to remove off-sets which would cause an abrupt change in thickness without suitable reinforcement. Taper edges to leave no square shoulders at the perimeter of a cavity. Remove loose material from areas receiving shotcrete. Wet the surface until it is damp, but without visible free water. [Remove paint, oil, grease and other contaminants and apply bonding agent to provide a surface for proper bonding of the shotcrete.]

3.03 ALIGNMENT CONTROL

A. Provide alignment wires to establish thickness and plane of required surfaces.

B. Install alignment wires at corners and offsets not established by forms.

C. Tighten alignment wires true to line. Position adjustment devices to permit additional tightening.

3.04 APPLICATION

A. Ensure sufficient clearance around reinforcement to permit complete encasement.

B. Allow easy access to shotcrete surfaces for screening and finishing to permit uninterrupted application.

C. Establish, and adhere to, operating procedures for placement in close quarters, at extended distances or around unusual obstructions where placement velocities and mix consistency must be adjusted.

D. When shotcreting walls, begin the application at the bottom and work upwards. Ensure that the work does not sag.

E. Direct nozzle perpendicular to surface to ensure maximum compaction with minimum rebound.

F. Build up thickness by layers, in multiple passes of the nozzle over the work area. Follow a routing that will fill and completely encase reinforcement, using maximum layer thickness.

G. Allow each layer to take initial set before applying succeeding layers.

H. After initial set, remove excess material outside of forms and alignment lines.

I. Remove laitance that has taken final set by sandblasting. Clean with air-water jet.

J. Sound work with hammer for voids. Cut out voids and replace with new shotcrete layers.

K. Remove trapped rebound at construction and expansion joints.

L. Remove rebound material which does not fall clear of the work. Discard salvaged rebound.

M. Keep rebound and other loose or porous material out of new construction.

N. Provide troweled finish of final layer. Avoid troweling of thin sections of shotcrete unless both troweling and commencement of moisture curing take place, within a relatively short period after placement of shotcrete. Do not scrape or cut to remove high spots until the shotcrete has become stiff enough to withstand pull of the cutting device.

O. Remove and replace all shotcrete which exhibits sags or sloughs, segregation, honeycombing, sand pockets or other obvious defects. Repair defective areas in accordance with the provisions of paragraph 3.02.E of this Section.

P. Keep completed surfaces wet for a minimum of seven days. Immediately after placement, protect shotcrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

Q. Protect shotcrete repair work from frost action or heavy water flow.

3.05 FIELD QUALITY CONTROL

A. Inspection and Testing will be performed under provisions of Division 01.

B. Testing Laboratory will:

1. Test and inspect materials as required to ensure compliance with specifications.

2. Collect and review tickets for each batch of shotcrete delivered. Annotate water added subsequent to batching.

3. Observe placement of preconstruction test panels. Take six cores from each panel; three with reinforcement and three non-reinforced. Visually inspect and grade in accordance with "Quality

Assurance" article. Test non-reinforced cores for compressive strength at 7 days.

4. Special Inspect shotcrete placement, as required by [CBC Section 1701.5, Item 12], for conformance with the Contract Documents.
5. Take 3-inch (75 mm) core specimens from field test panels and test for compressive strength in accordance with CBC 1924.10.
6. Take 3-inch (75 mm) core specimens from in place work to examine for structural soundness in accordance with [CBC 1924.11.2].

C. The Subcontractor shall:

1. Gun field test panels for strength testing in accordance with [CBC 1924.10]. Panels shall be minimum of 18 inches square.
2. Patch areas cored for testing.
3. Pay Testing Laboratory for investigating of low-strength compressive test results in accordance with [CBC Section 1905.6.4].

END OF SECTION

SECTION 03 3800
POST-TENSIONED CONCRETE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections apply to this section.

B. Related work in other Sections related to Post-tensioned Concrete include:

1. Section 01 45 29 Structural Testing Laboratory Services.
2. Section 03 10 00 Concrete Forming and Accessories.
3. Section 03 20 00 Concrete Reinforcing.
4. Section 03 30 00 Cast-In-Place Concrete.

1.02 SCOPE OF WORK

A. The post-tensioning supplier and installer shall furnish all labor, materials, services and equipment required to produce a complete post-tensioned structural system. The work shall include the following items:

1. Furnishing all post-tensioning materials including prestressing steel, anchorages, wedges, pocket formers, couplers, plates, support bars, chairs, tendon enclosures, and bursting reinforcement.
2. Placing of all items listed above.
3. Performing all post-tensioning operations including stressing, anchoring, trimming, encapsulating tendon anchors, and grouting pockets.
4. Cooperating with the Owner’s Testing Laboratory in their function of recording and reporting tendon elongation and tension applied to the prestressing steel.
5. Performing all engineering required to fully design a post-tensioning system that complies with the final force and tendon profiles as shown on the structural drawings and to prepare complete shop drawings and field placing drawings.

B. Tendons shall be unbonded as shown on the drawings.

1.03 ENVIRONMENTAL OBJECTIVES

A. The Owner has established environmental goals and strategies for achieving them for this project based upon the LEED® Green Building Rating System for New Construction & Major Renovations Version 2009, as developed by the U.S. Green Building Council. Refer to Division 01 Section "Sustainable Design Requirements.”

B. Manufacturer to supply documentation of level of compliance or non-compliance with the following requirements before consideration as an "acceptable manufacturer:"

1. The following are mandatory requirements for the overall project:
    a. The material(s) in the product(s) supplied shall have a recycled content such that the sum of the post-consumer recycled content plus one-half of the pre-consumer content constitutes at least [Percentage of required recycled materials]% of the total value of the material in the project.
    b. [Percentage of close proximity material]% of the product(s) supplied is extracted, processed, and manufactured regionally within a radius of 500 miles of this project.

1.04 REFERENCE STANDARDS AND CODES

A. American Concrete Institute (ACI):
   1. ACI 117 Specifications for Tolerances for Concrete Construction and Materials
   2. ACI 301. – Specification for Structural Concrete
   3. ACI 308.1 – Standard Specification for Curing Concrete
   4. ACI 318. – Building Code Requirements for Structural Concrete and Commentary
B. Concrete Reinforcing Steel Institute (CRSI): “Manual of Standard Practice”, CRSI MSP- 2.
C. Post-Tensioning Institute (PTI):
   1. “Specification for Unbonded Single Strand Tendons”.
   2. “Field Procedure Manual for Unbonded Single Strand Tendons”.
   3. “Post-Tensioning Manual”.
D. Local Building Code.

1.05 SYSTEM DESCRIPTION

A. Unbonded post-tensioning system described herein is intended to perform without long- term corrosion or other distress in an aggressive environment as defined in the Specification for Unbonded Single-Strand Tendons. Post-tensioning strand, couplers, intermediate, and end anchorages shall be completely protected with a watertight, encapsulated system. Tendon sheathing and grease shall be as specified herein.

1.06 SUBMITTALS

A. Due to the interdependent nature of Sections “03 10 00 – Concrete Forming and Accessories”, “03 20 00 – Concrete Reinforcing”, “03 30 00 - Cast-In-Place Concrete” and “03 38 00 - Post-Tensioned Concrete,” the Contractor shall review all supplier’s shop drawings/field-placing drawings against each other and inform Architect/Engineer of any potential interferences or conflicts.

B. Drawings, Reports, Procedures : Submittals shall be submitted for review and approval and shall include but not be limited to the following:
   1. Tendon layout, including dimensions, which locates the tendons in the horizontal plane. Detail horizontal curvature of tendons at block-outs, openings and anchorages, and show all openings in slabs and beams. Clearly designate each tendon.
   2. Size and grade of tendon profiles showing support heights and locations, and any required reinforcing support steel. Show clearly the location of each tendon and the method of support. Coordinate the location of post-tension anchorages to eliminate conflicts with other embedded items such as curtain wall anchorages, or other similar type anchorages.
   3. Value of the wobble and curvature coefficients and anchorage set used in the design to calculate the tendon elongation.
   4. Details of reinforcement around stressing pockets, closures and openings, including bursting reinforcement, and any interference with tendons. Coordinate with mild reinforcing steel drawings as required.
   5. Details of anchorages, the positive connection between the anchorage and sheathing, pocket formers, couplers, and other related hardware.
   6. Details of the method for sealing the anchorage recesses after the tendon stressing tails have been removed.

7. Clearance requirements for the hydraulic equipment and the dimensions of any stressing pockets required.
8. Sequence of construction, including installation, pouring, jacking procedure, and stressing sequences. Show all construction joints and related tendon details.
9. Samples of forms to be used for field record of stressing operations.
10. Type and thickness of post-tensioning sheathing.
11. Type and chemical analysis of P-T coating showing compliance with Table 1 of the .“Specification for Unbonded Single Strand Tendons”.
12. Shop drawings shall be signed and sealed by a qualified professional engineer, licensed in the state of Maryland who was in responsible charge of the drawing preparation.

C. Manufacturer's Data: Submit for review and approval.

1. Sample hardware, including but not limited to: Anchorage system, coated strand, wedges, pocket formers, and other sub-assemblies required for complete installation including all accessories required to complete the system. Submit valid Evaluation Service Report (ESR) from ICC Evaluation Service, Inc for each product.
2. Post-tensioning system brochures.
3. Complete post-tensioning procedure, including but not limited to: Stressing system, method of determining anchor force, method of determining tendon slack, and method of cutting off excess strand after anchorage.
4. Mill Certificates: Submit certified mill reports of post-tensioning steel immediately upon shipment indicating compliance with specified requirements for all material that is to be delivered to the project.
5. Equipment Calibration: Submit certification of the calibration of all ram and gauge sets to the Architect/Engineer as specified herein.
6. Certifications and other data as may be further required to demonstrate compliance with other items in this section.

D. Calculations:

1. Submit calculations showing all engineering required to fully design the post- tensioning system, including friction loss calculations, bursting reinforcement calculations, number of prestressing tendons, anchorage and coupling systems, tendon supports, and tendon stressing procedures, as required to fully comply with the final force and tendon profiles as shown on the structural drawings. The design shall be in accordance with the requirements of ACI 318. Submit tendon manufacturer’s data that documents the wobble and curvature friction coefficients used in the friction loss calculations. Clearly show on the shop drawings the values of wobble and curvature coefficients used in the design.
2. Post-Tensioning Supplier shall secure the services of a qualified professional engineer, licensed in the state of maryland, to provide the design as specified above. Calculations shall be signed and sealed by the professional engineer and shall be submitted to Architect/Engineer for Owner’s record only.
3. Review of shop drawings and calculations by the Architect/Engineer will not relieve the Post-Tensioning Supplier of responsibility for final design as specified herein.
4. By offering a proposal or entering into a contract for work of this Section, Post- Tensioning Supplier accepts the general design shown on the drawings as adequate for compliance with performance

requirements at no additional cost to the Owner.

E. Stressing Records: The contractor shall provide the appropriate cooperation and access to the Owner's Testing Laboratory to allow them to measure, record, and clearly report the following information. In the absence of a Testing Laboratory representative, the post-tensioning installer shall measure, record, report and submit the information described below. Submit records to the Architect/Engineer for approval within 24 hours after stressing.

1. Floor, pour and tendon identification numbers. For walls, indicate wall location.Calculated elongation and actual measured elongation for each jacking point, and totals for each tendon.
2. Stressing ram number, initial and final gauge load reading during stressing for each tendon.
3. Date of stressing operation and signature of the Contractor's stressing personnel and inspector witnessing the operation.
4. Range of allowable elongations for jacking force or a measure of the deviation of the measured elongations from the calculated elongations. Deviations that do not comply with the specified tolerances shall be noted for the Architect/Engineer to review.
5. Obvious irregularities or stress loss during anchoring procedures.
6. Required and actual concrete strength at time of jacking.

F. Record Drawings: The Contractor shall provide record drawings to the Owner, in care of the Architect/Engineer, of any approved changes from the contract documents. Form of record drawings may be legible marked-up prints of contract drawings, or separate drawings of same scale.

G. Review:

1. After review, shop drawings/field-placing drawings and data shall not be changed nor shall construction operations be deviated from, unless resubmitted under a cover letter delineating such change and reapproved.
2. Review of details and construction operations will not relieve the Contractor of his responsibility for completing the work successfully in accordance with the contract drawings and specifications.

H. LEED Submittals (Projects authorized for LEED certification only)

1. Recycled Content- Credit MR4.1/MR 4.2: Provide documentation indicating percentages of post-consumer and pre-consumer recycled content by weight per unit of product or assembly containing the product. Indicate the percentage of the dollar value of the recycled content compared to the total dollar value of the product or assembly containing the product.
2. Material Proximity- Credit MR 5.1/MR 5.2: Where the distance to the project site is 500 miles or less, indicate location and distance to project site of extraction, harvesting, recovery and manufacturing of all materials. Indicate the dollar value of the material cost of the product containing local/regional materials. Where product components are sourced or manufactured in separate locations, provide location and percentage by weight of each component per unit of product.

1.07 QUALITY ASSURANCE

A. Qualifications: The supply and installation of post-tensioning shall be executed by organizations that have successfully performed major work of a nature similar to that involved in this project for a minimum of five (5) years and have successfully completed a minimum of five (5) similar projects in own name, unless this requirement is waived by the Architect/Engineer prior to Contract award. The Contractor shall submit supporting evidence acceptable to the Architect/Engineer that this qualification has been met. Post-tensioning shall be performed using methods and related equipment that are in conformance with generally accepted systems of post-tensioning. Experienced individuals shall control and supervise all operations.

B. Fabrication Quality Assurance: The post-tensioning material shall be fabricated by a plant that is fully PTI-certified at the time of bidding, and that shall maintain this certification throughout the duration of this project as described in the Post-Tensioning Institute's "Manual for Certification of Plants Producing Unbonded Single Strand Tendons."Installer Quality Assurance: All installers of unbonded post-tensioned tendons shall be certified under the Post-Tensioning Institute's "Post-tensioning Certification Program of Field Personnel for Unbonded Post-tensioning Installers".

C. Inspection and Testing: Inspection and testing shall be provided in accordance with the Structural Testing Laboratory Services Specification.

D. Source Quality Control:

1. If requested by the Architect/Engineer, take two (2) strand samples from one end of each coil at the fabrication plant prior to greasing and sheathing. The Post- Tensioning Supplier shall notify the Architect/Engineer when the coils are ready to be sampled.
2. Submit certified mill reports indicating compliance with ASTM A416, and if requested, the test data showing evidence of compliance with the Low Relaxation Strand requirement of ASTM A416, to the Architect/Engineer immediately upon shipment for all material delivered to the project. The mill report shall be based upon a minimum of two (2) tests for each reel, heat or lot, and shall include as a minimum the breaking load, modulus of elasticity, elongation at rupture, load at 1% extension, diameter and area of strand, standard chemical analysis and drawing mill.
3. Furnish all materials and handling which testing agency requires. Submit certification by the Post-Tensioning Supplier that any submitted samples are representative of the material to be furnished.
4. Package the post-tensioning strands at the supplier's fabrication facility in a manner that prevents damage to strand and protects strand from moisture during transportation and storage.

E. Field Quality Control:

1. The Contractor shall maintain a consistent and good standard of workmanship. Check bulkheads, position of anchorages, tendon chairing and tying, location, size and placement of reinforcement, and tendon quantity.
2. Identify wedges and anchorages by individual concrete placement areas, floor sequence or both. Use materials only in their identified concrete placement areas. In the event materials intended for one concrete placement area are exchanged into another concrete placement area, notify architect/engineer and testing agency for tracking purposes.
3. Prior to pouring concrete, at a frequency as established for the project, an inspection of the tendons and mild reinforcing steel shall be made by the Architect/Engineer, or Independent Testing Agency. Placement of concrete shall not begin until acceptance of conditions is documented by the Architect/Engineer, or Independent Testing Agency.
4. Inspection of stressing operations shall also be performed as directed by the Architect/Structural Engineer.
5. The Contractor shall cooperate with the Owner's Testing Laboratory in their efforts to record tendon elongations. The Contractor shall keep a copy of the stressing records with the shop drawings.
6. Submit certificates of all ram and gauge calibrations used on the project to the Architect/Engineer. Use of non-calibrated ram and gauge sets are not allowed on this project. If requested by the Architect/Engineer, Owner, or Field Inspector, the Contractor shall have the ram and gauge sets calibrated by an Independent Testing Agency, the cost of which shall be borne by the Contractor.
7. Manufacture and deliver tendons in sequence and quantity so as to avoid lengthy job site storage. Deliver tendons as close as practicable to the designated storage area to avoid excessive handling.

Do not use chains or hooks to handle tendons.

8. Satisfactorily protect all prestressing steel from all moisture and rust or other physical damage prior to placement and keep steel free from deleterious substances, such as chlorides, fluorides, sulfites and nitrates. Provide protection for exposed prestressing steel beyond ends of members to prevent deterioration by rust or corrosion.
9. Do not store post-tensioning strand in such a manner that it is in direct contact with soil or fresh concrete or exposed to rain, snow, de-icing salts or other corrosive elements. Protect plastic materials planned to be stored for more than one month from exposure to sunlight.
10. Damage to tendon sheathing in excess of 2% of its length shall be grounds for rejection of sheathing.
11. Contractor shall inspect tendon sheathing for damage and to verify watertight seal between sheathing and anchor. Repair all damaged sheathing to the satisfaction of the Architect/Engineer.

PART 2 - PRODUCTS

2.01 POST-TENSIONING STEEL

A. Strand: Prestressing steel shall use strand conforming to ASTM A416, Low-Relaxation Type, and shall have a minimum guaranteed ultimate tensile strength of 270,000 psi based on the nominal area of the strand. The strand shall additionally conform to the “Specification for Unbonded Single Strand Tendons”. The strand shall be free of dirt, corrosion or injurious marks, scratches, seams, and sharp kinks. Surface rust shall be removed with a fine steel wool pad or by vigorous rubbing with a cloth. Pits on steel surface shall not exceed .002 in. in diameter or length. Oil-tempered strand is prohibited. Certified mill reports giving name of drawing mill shall be submitted.

B. Bar: Prestressing bars shall conform to ASTM A722, Type II-Deformed, and shall have a minimum ultimate tensile strength of 150 ksi.

C. Identification: All prestressing steel within every group or in the same member shall be of the same heat where practical. All tendons shall be assigned a proper heat and coil number and so identified on fabrication lists that are to be sent to the field with each shipment. Identify tendons in accordance with placing drawings. Unidentified steel shall not be allowed unless approved by the Architect/Engineer and tested.

D. Sheathing: All post-tensioning tendons shall be coated and sheathed with an approved slippage sheathing designed to prevent the intrusion of cement paste and the loss of the P-T coating material and be watertight and impermeable to water vapor over the entire length. Such sheathing shall enclose the prestressing steel that shall then be placed in the forms prior to placement of concrete. The sheathing shall be continuously extruded polyethylene or polypropylene with a minimum density of 0.034 lb./in., a minimum thickness of 50 mils, and an inside diameter at least .03 inches greater than the maximum diameter of the strand. The sheathing shall not rupture due to normal temperature changes, coiling and field handling. The sheathing material shall be chemically stable, without embrittlement or softening over the anticipated exposure temperature range and service life of the structure. It shall be non-reactive with concrete, prestressing steel, reinforcing steel, and corrosion preventive P-T coating. Heat-sealed or plastic-wrapped sheathing is not acceptable.

E. P-T Coating: The corrosion preventive coating shall lubricate the tendon and permanently protect the prestressing steel against corrosion. It shall resist flow caused by gravity within the anticipated temperature range of exposure and provide non-brittle coating at the lowest anticipated temperature of exposure. It shall be chemically stable and non-reactive with prestressing steel, reinforcing steel, sheathing material, and concrete. The coating shall be applied under pressure to ensure the filling of the interstices between the individual wires of the strand. There shall be no voids or pockets between the sheathing and the coated strand for water or air to collect. The minimum amount of coating on the

prestressing strand shall be 2.5 pounds of material per 100 feet of strand for a 0.5 inch diameter strand and 3.0 pounds per 100 feet for a 0.6 inch diameter strand. The P-T coating shall satisfy the requirements of table 1 of the ”Specification for Unbonded Single-Strand Tendons and Commentary”.

F. Repair tape: The tape used to repair damaged sections of sheathing or to wrap exposed strand shall be a minimum of 2 inches wide and shall be of a color that contrasts with the sheathing. The tape shall be self-adhesive and moisture-proof and shall be non-reactive with the sheathing, P-T coating, prestressing steel, or concrete.

2.02 MILD REINFORCEMENT

A. Refer to Specification Section 03 32 00 for requirements for mild reinforcement used as bursting reinforcement and tendon support.

2.03 ANCHORAGES AND COUPLERS

A. Performance and Specification:

1. Anchoring hardware shall be steel and shall meet the minimum requirements set forth in ACI 318, except as modified herein. The anchorage shall be capable of developing at least 95% of the minimum specified ultimate strength of the prestressing steel without exceeding anticipated set, and shall be capable of passing the static and dynamic tests as outlined in the PTI Post-Tensioning Manual. All anchorages, couplers, and miscellaneous hardware shall be the standard products as manufactured by the Post-Tensioning Supplier, unless shown otherwise, and shall be evaluated by the ICC Evaluation Service and be listed in a current Evaluation Service Report (ESR).
2. Anchors and couplers used shall include design features permitting a positive mechanical and watertight connection of the sheathing to the anchorage, and watertight closing of the wedge cavity, for stressing and non-stressing (fixed) anchorages. Friction connections between the anchor and the sheathing shall not be allowed. Intermediate stressing anchorages shall be designed to permit complete watertight encapsulation of the prestressing steel.
3. All anchorages shall have the demonstrated ability to remain watertight when subjected to a hydrostatic pressure of 1.25 psi over a period of 24 hours.
4. Sleeves used to connect the sheathing to the anchorages shall meet the same requirements as the sheathing for durability during fabrication, transportation, handling, storage and installation and have a minimum thickness of 50 mils. The overlap between the end of the extruded sheathing and the end of the sleeve and seal shall be a minimum of 4 inches. The sleeve shall be translucent or have another method to verify both that the P-T coating material is free of voids and the proper overlap with the sheathing.

B. Size: Anchorages and distribution (bearing) plates shall be sized according to ACI 318 unless certified test reports are submitted proving acceptable deviation. Bursting steel shall be designed by the Post-Tensioning Supplier consistent with the anchorage to be provided.

C. Anchorages at Construction Joints: At construction joints, all anchorages or tendon force distribution plates (bearing plates) shall be embedded in the first of the consecutive pours. Flat back castings, plates, etc. which are placed against previously cast concrete and then stressed shall not be allowed. Washer type grommets shall be used at construction joints if grout exclusion is necessary for the embedded item. Normal depth pockets at intermediate construction joints shall not be used unless adequate measures are taken to ensure that the pocket is completely filled with concrete during subsequent pours.

D. Seating loss: Maximum allowable anchor slip or seating loss shall be 1/4 inch.

2.04 CONCRETE

A. The concrete shall have a minimum 28-day strength as specified on the drawings. Components or admixtures with chloride, fluoride, sulphite or nitrate ions or any other substance deleterious to prestressing steel shall not be used.

B. The chloride ion content of the concrete used in post-tensioned concrete contributed from the water, aggregate, cementitious materials and admixtures used in the mix shall not be greater than 0.06 percent by weight of cement.

C. See Section 03 30 00 Cast-In-Place Concrete for additional requirements for concrete.

2.05 TENDON SUPPORT SYSTEM

A. Slab Tendons: Support points shall consist of a bar support and continuous orthogonal steel as shown on the Contract Drawings. Bar supports shall be plastic, plastic tipped, epoxy coated or stainless steel.

B. Beam Tendons: Supports shall consist of reinforcing steel tied between stirrup legs as shown on the Contract Drawings.

C. For exterior exposure conditions, any supports that come in contact with the forming surface shall be plastic tipped stainless steel or high density plastic (grey in color).

2.06 PRE-CONSTRUCTION CONFERENCE

A. At least 30 days prior to post-tensioned concrete construction, the Contractor shall hold a meeting to review the detailed requirements for preparing the concrete design mixes and to determine the procedures for producing proper post-tensioned concrete construction. Also review requirements for submittals, status of coordinating work and availability of materials. Establish work progress schedule and procedures for materials inspection, testing and certifications.

B. The Contractor shall require responsible representatives of every party who is concerned with the post-tensioned concrete work to attend the conference, including but not limited to the following:

1. Contractor's Superintendent
2. Laboratory responsible for the concrete design mix
3. Laboratory responsible for field quality control
4. Concrete Subcontractor
5. Post-Tensioning Supplier
6. Post-Tensioning and Mild-Reinforcement Installer
7. Ready-Mix Concrete Producer
8. Admixture Manufacturer(s)
9. Concrete Pumping Equipment Manufacturer
10. MEP Subcontractor
11. Owner's and Architect's/Engineer's Representative
12. Engineer-of-Record

C. Minutes of the meeting shall be recorded, typed and printed by the Contractor and distributed to all parties concerned within 5 days of the meeting. One copy of the minutes shall be transmitted to the following for information purposes:

1. Owner's Representative
2. Architect
3. Engineer-of-Record

D. The Contractor shall coordinate the scheduled date of the conference with the Architect/Engineer.

PART 3 - EXECUTION

3.01 POST-TENSIONING STEEL PLACEMENT

A. Profile: Post-tensioning tendons shall conform to the control points shown on the Contract Drawings and approved shop drawings and shall have a parabolic drape between supports unless noted otherwise. Harped tendons shall be straight between control points as shown on the drawings. Dimensions locating this profile apply to the center of gravity of the tendons. Low points of the tendons are at mid-span unless noted otherwise. Place the tendons normal to and concentric with anchorage plates. The transition curvature in tendon profile shall not start closer than 1 foot from end anchorages.

B. Interference: Slight deviation in spacing of the slab tendons is permitted where required to avoid openings and inserts that are specifically located. Horizontal sweeps to miss openings, inserts, etc. shall have minimum radius of 480 strand diameters. Where radius of curvature less than 480 diameters is necessary, contact the Architect/Engineer before moving those tendons. Coordinate the placement of mild steel reinforcement with placement of post-tensioning tendons. Proper tendon location has priority. Maintain sufficient concrete cover around tendons. Coordinate bursting steel requirements with details and post-tensioning subcontractor.

C. Tolerances: Firmly support tendons and anchorages to prevent displacement during subsequent operations. Place them with a vertical tolerance of plus or minus 1/4 inch in concrete members with depths of 8 inches or less, plus or minus 3/8 inch in concrete depths over 8 inches but less than 24 inches, and plus or minus 1/2 inch in concrete depths over 24 inches. In no case shall tendons violate the absolute minimum cover stated in ACI 117. Maintain a minimum clearance of 6 inches at all openings. Twisting or entwining of individual tendons within a bundle is not permitted.

D. Tendon Spacing: Maximum spacing of slab tendons shall be eight (8) times the thickness of the slab, but not greater than 54 inches, unless otherwise noted on the Contract Drawings. Bundle tendons in such a manner to allow proper concreting and the maintenance of the center of gravity of steel.

E. Supports: Provide a sufficient number of horizontal and vertical positioning supports to firmly support tendons to prevent displacement due to construction operations. Spacing of supports shall not exceed 4’-0” on center. Show all support devices on the shop drawings.

F. Welding: Welding of cross bars or any welding in the vicinity of the tendons is not allowed. Do not use post-tensioning tendons as an electrical ground for welding operations.

G. Sheathing

1. The sheathing shall be continuous from end to end of all stressing anchorages and all embedded dead ends including intermediate anchorages, unless shown otherwise on the Contract Drawings, or otherwise approved by the Architect/Engineer.

2. After installing the tendons and prior to concrete placement, inspect the sheathing on each tendon for its entire length to detect possible damage. Repair any detected tears or abrasions by procedures conforming to the “Field Procedures Manual for Unbonded Single Strand Tendons” by PTI. The repair of sheathing shall prevent intrusion of cement paste or loss of coating. The repair of sheathing shall also be watertight and approved by the Architect/Engineer.

H. Encapsulation: Complete the encapsulation of the post-tensioning system the same day as the tendons are installed.

I. Couplers: Do not use tendon couplers without prior approval of the Architect and Structural Engineer.

3.02 ANCHORAGES AND BLOCK-OUTS

A. Attachment

1. Attach anchorages securely to bulkhead forms using fasteners that will not corrode or are protected from corroding such that the anchor is perpendicular to the tendon axis.
2. Cover: Top, bottom, and edge concrete cover for anchorages shall be not less than the specified cover for reinforcement. Minimum concrete cover from the exterior edge of the concrete to wedge cavity area of anchor shall be 2 inches, unless otherwise noted on the drawings.

B. Bursting Reinforcement:

1. Provide and install bursting reinforcement behind anchorages as required by calculations subject to the following minimums:
   a. Slab: Provide 2-#4 bars, one above and one below the tendon, continuous along concrete edges behind slab anchorages. Provide a #3 hairpin with 9” long legs around continuous #4’s between each anchorage. Provide 2-#4 corner bars with 3’-6” legs, one each above and below the tendon center of gravity.
   b. Beam: Provide 2-#4 bars, horizontal or vertical, with appropriate development length, behind all beam anchorages.

C. Block-outs and Pockets:

1. Adequately reinforce all block-outs or pockets required for anchorages so as to not decrease the strength of the structure.
2. Pocket formers used to provide a void form at anchorages shall be designed to prevent intrusion of concrete or cement slurry into the wedge cavity.
3. Do not coat block-out forms or pocket formers with grease, form oil, or any other substance that will decrease the bonding capacity of the patching grout to the surrounding concrete.
4. Install sleeves and seals connecting sheathing to anchorage to completely seal tendon against moisture infiltration.

3.03 CONCRETE PLACEMENT

A. Formwork: Design of the formwork shall take into account the possibility of the slab or girder lifting off the formwork during tensioning, thereby transferring the entire load to the support areas. Construct the formwork to permit movement of the member without damage during application of the post-tensioning force. Supporting forms in post- tensioned areas are not to be removed until concrete is fully stressed or as required by Section 03 10 00 whichever is later. The Contractor shall submit his proposed shoring and reshoring schemes prior to commencement of forming work.

B. Construction Joints: Locate construction joints at or near where the center-of-gravity of the strands coincides with the center-of-gravity of the concrete section unless otherwise approved by the Architect/Engineer. The contractor shall submit construction joint locations in post-tensioned members to the Architect/Engineer for approval.

C. Inserts, Anchors, and Coring: All inserts and anchors for suspended mechanical and architectural work shall be cast-in-place wherever feasible. Additional fasteners will be permitted only when it can be shown that the inserts will not spall concrete and are located so as to avoid hitting tendons or anchorages. The Contractor shall identify tendon locations on the surface of the slab if drilling or coring is to be done after concrete is placed.

D. Placement: Place the concrete in conformance with the requirements of the Specifications. Do not place the concrete until the Architect/Engineer, or Independent Testing Laboratory has inspected the placement of the mild steel reinforcement and tendons at the frequency established for the project. Place the concrete in such a manner as to ensure that alignment of post-tensioning tendons remains unchanged. Make special provisions to ensure proper vibration of the concrete around the anchorage

plates. When concrete is distributed across an area being poured y way of horizontally supported slick-tube and/or rubber pump hose, the slick-tube and/or rubber hose shall be supported in such a way that does not contact the reinforcing steel or post-tensioning tendons. The slick-tube and/or rubber hose shall be braced to prevent surging of the lines that could dislodge the reinforcing and/or tendon locations. Monitor the tendon positioning during the concrete placement. All floors below the level that is to have concrete placement shall have been stressed before this concrete is placed, unless the shoring has been designed for the ensuing loads.

E. Openings: Openings shall not be cut into cast concrete without the approval of the Architect/Engineer.

3.04 STRESSING

A. Methods: Perform post-tensioning by methods and related equipment that are in conformance with generally accepted systems of post-tensioning. Variations of such generally accepted methods and equipment will be permitted with Architect/Engineer approval, provided equal results can be obtained.

B. Concrete Strength: Do not begin the post-tensioning operations until tests or readings have indicated that the concrete in the members has attained a compressive strength that is adequate for the requirements of the anchorages but not less than 3000 psi unless otherwise specified on the Contract Drawings. See Concrete Formwork section 03 10 00 for acceptable methods for determining in situ concrete strengths.

C. Equipment: Stress all tendons by means of hydraulic rams, equipped with accurate reading hydraulic pressure gauges that have been individually calibrated with a particular ram to permit the stress in the prestressing steel to be computed at any time. A certified calibration curve shall accompany each ram and gauge set. Immediately recalibrate the ram and gauge set if inconsistencies between the measured elongation and the gauge reading occur.

D. Forces: Anchor the prestressing steel at an initial or anchor force that will result in the ultimate retention of the working or effective force shown on the plans. Jacking forces shall be those indicated on the shop drawings. The length of a tendon pull more than that shown by the required friction calculations or more than 125 feet for a one-way pull or 250 feet for a two-way pull is not permitted unless it is justified by calculations and specifically approved by the Architect/Engineer. The Field Inspector shall verify the wobble and curvature friction coefficients during the stressing operation and shall report to the Post-Tensioning Engineer deviations greater than 10% from the values assumed in the design. Required adjustments to the stressing operation shall be recommended by the Post-Tensioning Engineer and approved by the Architect/Engineer.

E. Elongations: Keep records of all tendon elongations as previously described in this Section. Agreement within 7% between the gauge reading and the measured elongation and between the measured and the calculated elongation after stressing will be considered satisfactory. Deviations greater than 7% will be reported to the Architect/Engineer prior to completing stressing operation. No tensioning will be permitted until it is demonstrated that the prestressing steel is reasonably free and unbonded in the enclosure. Evidence that the steel is unbonded will be considered satisfactory if inward movement of steel is observed at one end of the tendon when a nominal pull is applied to the steel at the other end. The Architect/Engineer may order a force/elongation check at any time. Do not cut off tendons until elongation records have been reviewed and approved in writing by the Architect/Engineer.

F. Stressing Sequence: The stressing sequence shall be as shown on the approved shop drawings. Use the following general stressing sequence except as otherwise noted or approved by the Architect/Engineer.

	Beam and Slab:	Step #1.	Stress temperature tendons, if applicable.
		Step #2.	Stress continuous uniform slab tendons.
		Step #3.	Stress added uniform slab tendons.
		Step #4.	Stress continuous beam tendons.
		Step #5.	Stress added beam tendons.

		Step #6.	Stress girder tendons, if applicable.

G. Safety: Precautions shall be taken to prevent workers from standing directly behind, above or in front of the stressing rams.

H. Broken Tendons: The total loss of prestressing force in any post-tensioned concrete member due to unreplaced broken tendons shall not exceed 2% of the total prestressing force, unless otherwise accepted by the Architect/Engineer.

3.05 GROUTING ANCHORAGE RECESSES

A. Cut the tendon tails within 24 hours after the stressing records have been approved. Cut off the excess strand at least 1/2 inch inside the face of the finished concrete surface, and not more than 3/4 inch from the face of the anchorage. Cutting may be done by means of abrasive wheel, hydraulic shears, or, to prevent heating of the wedges, oxy- gasoline cutting flame is permitted. Do not allow the wedges to become heated.

B. Cover the end of tendon with approved coating-filled encapsulation cap, or other approved method no more than 24 hours after the tendon tails have been cut to ensure encapsulation of the exposed tendon.

C. Coat the anchorage recesses with an approved bonding agent and fill flush with a non- shrink, non-stain, chloride free grout compatible for use with prestressing steel or approved equal in accordance with manufacturer’s recommendations. Do not allow contamination of the anchorage recess surface that reduces the bonding capacity of the non-shrink grout.

3.06 INSTALLATION SUPERVISION

A. The duties of the post-tensioning installer's supervisor shall include:

1. Check tendon placement before and during pouring of concrete. Be present during pours and check for tendons being moved out of position.
2. Mark tendons prior to stressing and verify with the Owner’s Testing Laboratory that all initial marks are accurate.
3. Observe that tendon elongation measurements are made and recorded by Testing Laboratory or, in the absence of a Testing Laboratory representative, measure, record and report tendon elongations after stressing and submit copy of original to Architect/Engineer.
4. Compare results of actual tendon elongations with hydraulic ram gage reading and with calculated elongation.
5. Require checking of tendon force and/or elongation if requested by the Architect/Engineer.
6. Do not allow cutting off of tendons without the Architect/Engineer's written approval.

B. QUALITY ASSURANCE TESTING AND INSPECTION DURING CONSTRUCTION

1. See Testing Laboratory Services section of these Specifications for post-tensioning inspection and test requirements.

END OF SECTION

SECTION 03 4100
PRECAST STRUCTURAL CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Precast structural concrete.

1.02 RELATED REQUIREMENTS:

A. Section 033000 "Cast-in-Place Concrete" for concrete topping.

B. Section 051200 "Structural Steel Framing" for furnishing and installing connections attached to structural-steel framing.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each precast concrete mixture

C. Shop Drawings:

1. Include member locations, plans, elevations, dimensions, shapes and sections, openings, support conditions, and types of reinforcement, including special reinforcement.
2. Detail fabrication and installation of precast structural concrete units, including connections at member ends and to adjoining construction.
3. Indicate joints, reveals, drips, chamfers, and extent and location of each surface finish.
4. Indicate separate face and backup mixture locations and thicknesses.
5. Indicate type, size, and length of welded connections by AWS standard symbols.
6. Detail loose and cast-in hardware, lifting and erection inserts, connections, and joints.
7. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
8. Include and locate openings larger than 10 inches (250 mm). Where additional structural support is required, include header design.
9. Indicate location of each precast structural concrete unit by same identification mark placed on panel.
10. Indicate relationship of precast structural concrete units to adjacent materials.
11. Indicate locations, dimensions, and details of thin-brick units, including corner units and special shapes, and joint treatment.
12. Indicate locations, dimensions, and details of stone facings, anchors, and joint widths.
13. Indicate estimated camber for precast floor slabs with concrete toppings.
14. Indicate shim sizes and grouting sequence.
15. If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.

D. Delegated-Design Submittal: For precast structural concrete indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer licensed in the State of Michigan responsible for their preparation.

1. Show precast structural concrete unit types, connections, types of reinforcement, including special reinforcement, and concrete cover on reinforcement. Indicate location, type, magnitude, and direction of loads imposed on the building structural frame from precast structural concrete.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator.

B. Welding certificates.

C. Material Certificates: For the following:

1. Cementitious materials.
2. Reinforcing materials and prestressing tendons.
3. Admixtures.
4. Bearing pads.
5. Insulation.
6. Structural-steel shapes and hollow structural sections.

D. Material Test Reports: For aggregates, by a qualified testing agency.

E. Field quality-control and special inspection reports.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm that assumes responsibility for engineering precast structural concrete units to comply with performance requirements. Responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

1. Designated as a PCI-certified plant as follows:
   a. Group C, Category C2 - Prestressed Hollowcore and Repetitively Produced Products

B. Installer Qualifications: A precast concrete erector qualified and designated by PCI's Certificate of Compliance, to erect Category S1 – Simple Structural Systems.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.4/D1.4M, "Structural Welding Code - Reinforcing Steel."

1.07 COORDINATION

A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction before starting that Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Support units during shipment on nonstaining shock-absorbing material in same position as during storage.

B. Store units with adequate bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.

1. Store units with dunnage across full width of each bearing point unless otherwise indicated.

2. Place adequate dunnage of even thickness between each unit.
3. Place stored units so identification marks are clearly visible, and units can be inspected.

C. Handle and transport units in a manner that avoids excessive stresses that cause cracking or damage.

D. Lift and support units only at designated points indicated on Shop Drawings.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer licensed in the State of Michigan to design precast structural concrete.

B. Design Standards: Comply with ACI 318 (ACI 318M) and with design recommendations in PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of precast structural concrete units indicated.

C. Fire-Resistance Calculations: Where required, provide precast structural concrete units whose fire resistance meets prescriptive requirements of authorities having jurisdiction and is acceptable to authorities having jurisdiction.

D. Structural Performance: Precast structural concrete units and connections shall withstand design loads indicated within limits and under conditions indicated.

E. Structural Performance: Provide precast structural concrete units and connections capable of withstanding the design loads described on the structural drawings:

1. Fire-Resistance Rating: Select material and minimum thicknesses to provide required fire rating.

2.02 MOLD MATERIALS

A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that provides continuous precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.

1. Mold-Release Agent: Commercially produced form-release agent that does not bond with, stain, or adversely affect precast concrete surfaces and does not impair subsequent surface or joint treatments of precast concrete.

B. Surface Retarder: Chemical set retarder, capable of temporarily delaying setting of newly placed concrete mixture to depth of reveal specified.

2.03 REINFORCING MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

C. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

D. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 116.

2.04 PRESTRESSING TENDONS

A. Pretensioning Strand: ASTM A 416/A 416M, Grade 250 (Grade 1720) or Grade 270 (Grade 1860), uncoated, seven-wire, or ASTM A 886/A 886M, Grade 270 (Grade 1860), indented, seven-wire, low-relaxation strand.

B. Unbonded Post-Tensioning Strand: ASTM A 416/A 416M, Grade 270 (Grade 1860), uncoated, seven-wire, low-relaxation strand.

1. Coat unbonded post-tensioning strand with post-tensioning coating complying with ACI 423.7 and sheath with polypropylene tendon sheathing complying with ACI 423.7. Include anchorage devices and coupler assemblies.

C. Post-Tensioning Bars: ASTM A 722/A 722M, uncoated high-strength steel bar.

2.05 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type I or Type III, gray, unless otherwise indicated.

1. For surfaces exposed to view in finished structure, use gray or white cement, of same type, brand, and mill source.

B. Supplementary Cementitious Materials:

1. Fly Ash: ASTM C 618, Class C or F, with maximum loss on ignition of 3 percent.
2. Metakaolin: ASTM C 618, Class N.
3. Silica Fume: ASTM C 1240, with optional chemical and physical requirement.
4. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

C. Normal-Weight Aggregates: Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.

D. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 116.

E. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

F. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.

2.06 STEEL CONNECTION MATERIALS

A. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.

B. Carbon-Steel-Headed Studs: ASTM A 108, Grade 1010 through 1020, cold finished, AWS D1.1/D1.1M, Type A or B, with arc shields and with minimum mechanical properties of PCI MNL 116.

C. Carbon-Steel Plate: ASTM A 283/A 283M, Grade C.

D. Malleable-Iron Castings: ASTM A 47/A 47M, Grade 32510 or Grade 35028.

E. Carbon-Steel Castings: ASTM A 27/A 27M, Grade 60-30 (Grade 415-205).

F. High-Strength, Low-Alloy Structural Steel: ASTM A 572/A 572M.

G. Carbon-Steel Structural Tubing: ASTM A 500/A 500M, Grade B or Grade C.

H. Wrought Carbon-Steel Bars: ASTM A 675/A 675M, Grade 65 (Grade 450).

I. Deformed-Steel Wire or Bar Anchors: ASTM A 496/A 496M or ASTM A 706/A 706M.

J. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); carbon-steel, hex-head bolts and studs; carbon-steel nuts, ASTM A 563 (ASTM A 563M); and flat, unhardened steel washers, ASTM F 844.

K. High-Strength Bolts and Nuts: ASTM A 325 (ASTM A 325M) or ASTM A 490 (ASTM A 490M,) Type 1, heavy hex steel structural bolts; heavy hex carbon-steel nuts, ASTM A 563 (ASTM A 563M); and hardened carbon-steel washers, ASTM F 436 (ASTM F 436M)

1. Do not zinc coat ASTM A 490 (ASTM A 490M) bolts.

L. Zinc-Coated Finish: For exterior steel items, steel in exterior walls, and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A 123/A 123M or ASTM A 153/A 153M.

1. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035B or SSPC- Paint 20.

M. Shop-Primed Finish: Prepare surfaces of nongalvanized-steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP 3, and shop apply, rust-inhibitive primer, complying with performance requirements in MPI 79 according to SSPC-PA 1.

N. Welding Electrodes: Comply with AWS standards.

O. Precast Accessories: Provide clips, hangers, plastic or steel shims, and other accessories required to install precast structural concrete units.

2.07 BEARING PADS

A. Provide one of the following bearing pads for precast structural concrete units as recommended by precast fabricator for application:

1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 Shore, Type A durometer hardness, ASTM D 2240; minimum tensile strength 2250 psi (15.5 MPa), ASTM D 412.

2. Random-Oriented-Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. 70 to 90 Shore, Type A durometer hardness, ASTM D 2240; capable of supporting a compressive stress of 3000 psi (20.7 MPa) with no cracking, splitting, or delaminating in the internal portions of pad. Test one specimen for every 200 pads used in Project.

3. Frictionless Pads: PTFE, glass-fiber reinforced, bonded to stainless- or mild-steel plate, or random-oriented-fiber-reinforced elastomeric pads; of type required for in-service stress.

4. High-Density Plastic: Multimonomer, nonleaching, plastic strip.

2.08 ACCESSORIES

A. Precast Accessories: Provide clips, hangers, high-density plastic or steel shims, and other accessories required to install structural precast concrete units.

2.09 GROUT MATERIALS

A. Sand-Cement Grout: Portland cement, ASTM C 150/C 150M, Type I, and clean, natural sand, ASTM C 144 or ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 to 3 parts sand, by volume, with minimum water required for placement and hydration. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C 1218/C 1218M.

B. Nonmetallic, Nonshrink Grout: Packaged, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application within a 30- minute working time. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C 1218/C 1218M.

C. Epoxy-Resin Grout: Two-component, mineral-filled epoxy resin; ASTM C 881/C 881M, of type, grade, and class to suit requirements.

2.10 CONCRETE MIXTURES

A. Prepare design mixtures for each type of precast concrete required.

1. Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.

B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast structural concrete fabricator's option.

C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 (ACI 318M) or PCI MNL 116 when tested according to ASTM C 1218/C 1218M.

D. Normal-Weight Concrete Mixtures: Proportion by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal- weight concrete with the following properties:

1. Compressive Strength (28 Days): 5000 psi (34.5 MPa).
2. Maximum Water-Cementitious Materials Ratio: 0.45.

E. Water Absorption: For structural precast concrete with an architectural finish, limit water absorption to 6 percent by weight or 14 percent by volume, tested according to ASTM C 642, except for boiling requirement.

F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 116.

G. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

H. Concrete Mix Adjustments: Concrete mix design adjustments may be proposed if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

2.11 FABRICATION

A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.

1. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."

B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing precast structural concrete units to supporting and adjacent construction.

C. Cast-in reglets, slots, holes, and other accessories in precast structural concrete units as indicated on the Contract Drawings.

D. Cast-in openings larger than 10 inches (250 mm) in any dimension. Do not drill or cut openings or prestressing strand without Architect's approval.

E. Reinforcement: Comply with recommendations in PCI MNL 116 for fabricating, placing, and supporting reinforcement.

1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcement exceeds limits specified in ASTM A 775/A 775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.

3. Place reinforcing steel and prestressing strand to maintain at least 3/4-inch (19-mm) minimum concrete cover. Increase cover requirements for reinforcing steel to 1-1/2 inches (38 mm) when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
4. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.

F. Reinforce precast structural concrete units to resist handling, transportation, and erection stresses and specified in-place loads.

G. Prestress tendons for precast structural concrete units by either pretensioning or post-tensioning methods. Comply with PCI MNL 116.

1. Delay detensioning or post-tensioning of precast, prestressed structural concrete units until concrete has reached its indicated minimum design release compressive strength as established by test cylinders cured under same conditions as concrete unit.
2. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.
3. If concrete has been heat cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.
4. Protect strand ends and anchorages with bituminous, zinc-rich, or epoxy paint to avoid corrosion and possible rust spots.
5. Protect strand ends and anchorages with a minimum of 1-inch- (25-mm-) thick, nonmetallic, nonshrink, grout mortar and sack rub surface. Coat or spray the inside surfaces of pocket with bonding agent before installing grout.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, bearing surface tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Do not install precast concrete units until supporting, cast-in-place concrete has attained minimum allowable design compressive strength and until supporting steel or other structure is structurally ready to receive loads from precast concrete units.

3.02 INSTALLATION

A. Install clips, hangers, bearing pads, and other accessories required for connecting precast structural concrete units to supporting members and backup materials.

B. Erect precast structural concrete level, plumb, and square within specified allowable tolerances. Provide temporary structural framing, shoring, and bracing as required to maintain position, stability, and alignment of units until permanent connections are complete.

1. Install temporary steel or plastic spacing shims or bearing pads as precast structural concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.

3. Remove projecting lifting devices and use plastic patch caps or sand-cement grout to fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
4. For hollow-core slab voids used as electrical raceways or mechanical ducts, align voids between units and tape butt joint at end of slabs.

C. Connect precast structural concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.
1. Do not permit connections to disrupt continuity of roof flashing.

D. Field cutting of precast units is not permitted without approval of Architect.

E. Fasteners: Do not use drilled or powder-actuated fasteners for attaching accessory items to precast, prestressed concrete units.

F. Welding: Comply with applicable requirements in AWS D1.1/D1.1M and AWS D1.4/D1.4M for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.
1. Protect precast structural concrete units and bearing pads from damage by field welding or cutting operations, and provide noncombustible shields as required.
2. Clean weld-affected steel surfaces with chipping hammer followed by brushing, and apply a minimum 4.0-mil- (0.1-mm-) thick coat of galvanized repair paint to galvanized surfaces according to ASTM A 780/A 780M.
3. Clean weld-affected steel surfaces with chipping hammer followed by brushing, and reprime damaged painted surfaces.
4. Visually inspect welds and remove, reweld, or repair incomplete and defective welds.

G. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.
1. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot.
2. For slip-critical connections, use one of the following methods to assure proper bolt pretension:
    a. Turn-of-Nut: According to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
    b. Calibrated Wrench: According to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
    c. Twist-off Tension Control Bolt: ASTM F 1852.
    d. Direct-Tension Control Bolt: ASTM F 1852.
3. For slip-critical connections, use method and inspection procedure approved by Architect and coordinated with inspection agency.

H. Grouting or Dry-Packing Connections and Joints: Grout connections and joints and open spaces at keyways, connections, and joints where required or indicated on Shop Drawings.

I. Retain flowable grout in place until hard enough to support itself. Alternatively, pack spaces with stiff dry-pack grout material, tamping until voids are completely filled.
1. Place grout and finish smooth, level, and plumb with adjacent concrete surfaces.
2. Fill joints completely without seepage to other surfaces.

3. Trowel top of grout joints on roofs smooth and uniform. Finish transitions between different surface levels not steeper than 1 to 12.
4. Place grout end cap or dam in voids at ends of hollow-core slabs.
5. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.
6. Keep grouted joints damp for not less than 24 hours after initial set.

3.03 ERECTION TOLERANCES

A. Erect precast structural concrete units level, plumb, square, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 135.

B. Minimize variations between adjacent slab members by jacking, loading, or other method recommended by fabricator and approved by Architect.

3.04 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Erection of precast structural concrete members.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. Visually inspect field welds and test according to ASTM E 165 or to ASTM E 709 and ASTM E 1444. High-strength bolted connections are subject to inspections.

D. Testing agency will report test results promptly and in writing to Contractor and Architect.

E. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.

F. Additional testing and inspecting, at Contractor's expense, shall be performed to determine compliance of replaced or additional work with specified requirements.

G. Prepare test and inspection reports.

3.05 REPAIRS

A. Repair precast structural concrete units if permitted by Architect.

1. Repairs may be permitted if structural adequacy, serviceability, durability, and appearance of units have not been impaired.

B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet (6 m).

C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780/A 780M.

D. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.

E. Remove and replace damaged precast structural concrete units that cannot be repaired or when repairs do not comply with requirements as determined by Architect.

3.06 CLEANING

A. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.

B. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.

1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's written recommendations. Protect other work from staining or damage due to cleaning operations.
2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION

SECTION 03 4500
PRECAST ARCHITECTURAL CONCRETE

PART I - GENERAL

1.01 DESCRIPTION

A. Work of this Section includes all materials and installation necessary to provide:

1. Precast architectural concrete units.
2. Insulated, precast architectural concrete units.
3. Thin-brick-faced, precast architectural concrete units.
4. Stone-faced, precast architectural concrete units.
5. Materials and installation of new Concrete, Concrete Formwork and Concrete Reinforcement as shown and detailed on the drawings and specified herein.

1.02 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide precast architectural concrete units and connections capable of withstanding design loads within limits and under conditions indicated.

B. Structural Performance: Provide precast architectural concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated:

1. Dead Loads:
2. Live Loads:
3. Wind Loads:
4. Seismic Loads:
5. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
    a. Upward and downward movement of ½".

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixes: For each concrete mix.

C. Shop Drawings: Detail fabrication and installation of precast architectural concrete units. Indicate member locations, plans, elevations, dimensions, shapes, cross sections, limits of each finish, and types of reinforcement, including special reinforcement.

1. Indicate separate face and backup mix locations and thicknesses.
2. Indicate locations and extent and treatment of dry joints if two-stage casting is proposed.
3. Indicate welded connections by AWS standard symbols. Detail loose and cast-in hardware, inserts, connections, and joints, including accessories.
4. Indicate locations and details of anchorage devices to be embedded in other construction.
5. Indicate locations and details of thin brick units and joint treatment.
6. Indicate locations and details of stone facings, anchors, and treatment of joints.
7. Comprehensive engineering analysis certified by the qualified professional engineer responsible for its preparation.

D. Samples: For each type of finish indicated on exposed surfaces of precast architectural concrete units, in sets of 3, illustrating full range of finish, color, and texture variations expected; approximately 12 x 12 x 2”.

E. Samples for each thin brick unit required, including special shapes, showing the full range of colors, textures, and dimensions expected.

1. Grout Samples for Initial Selection: Color charts consisting of actual sections of grout showing the manufacturer's full range of colors.

F. Welding Certificates: Copies of certificates for welding procedures and personnel.

G. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated:

H. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

1. Concrete materials.
2. Reinforcing materials and prestressing tendons.
3. Admixtures.
4. Bearing pads.
5. Water-absorption test reports.
6. Thin brick units and accessories.
7. Stone accessories.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed precast architectural concrete work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Fabricator Qualifications: A firm that complies with the following requirements and is experienced in manufacturing precast architectural concrete units similar to those indicated for this Project and with a record of successful in-service performance.

1. Assumes responsibility for engineering precast architectural concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
2. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of precast architectural concrete that are similar to those indicated for this Project in material, design, and extent.
3. Participates in PCI's Plant Certification program and is designated a PCI-certified plant for Group A, Category A1 - Architectural Cladding and Load Bearing Units.
4. Has sufficient production capacity to produce required units without delaying the Work.
5. Is registered with and approved by authorities having jurisdiction.

C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

D. Design Standards: Comply with ACI 318 and the design recommendations of PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete."

E. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."

F. Product Options: Drawings indicate size, profiles, and dimensional requirements of precast concrete units and are based on the specific types of units indicated. Other fabricators' precast concrete units complying with requirements may be considered. Refer to Division 1 Product Requirements.

G. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code-Steel"; and AWS D1.4, "Structural Welding Code-Reinforcing Steel."

H. Calculated Fire-Test-Response Characteristics: Where indicated, provide precast architectural concrete units whose fire resistance has been calculated according to PCI MNL 124, "Design for Fire Resistance of Precast Prestressed Concrete," ACI 216.1/TMS 0216.1, "Standard Method for Determining Fire Resistance of Concrete and Masonry Construction Assemblies," and is acceptable to authorities having jurisdiction.

I. Sample Panels: Before fabricating precast architectural concrete units, produce sample panels to establish the approved range of selections made under sample Submittals. Produce a minimum of 3 sets of full-scale sample panels, approximately 48” (1200 mm) long x 48” (1200 mm) high, to demonstrate the expected range of finish, color, and texture variations.

1. Locate panels where indicated or, if not indicated, as directed by Owner's Representative.
2. In presence of Owner's Representative, damage part of an exposed-face surface for each finish, color, and texture, and demonstrate materials and techniques proposed for repair of surface blemishes to match adjacent undamaged surfaces.
3. Maintain sample panels during construction in an undisturbed condition as a standard for judging the completed Work.
4. Demolish and remove sample panels when directed.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver precast architectural concrete units to Project site in such quantities and at such times to ensure continuity of installation. Store units at Project site to prevent cracking, distorting, warping, staining, or other physical damage, and so markings are visible.

B. Lift and support units only at designated lifting and supporting points as shown on Shop Drawings.

1.06 SEQUENCING

A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.01 FABRICATORS

A. Fabricators: Subject to compliance with requirements: MOLD MATERIALS

B. Molds: Provide molds and, where required, form-facing materials of metal, plastic, wood, or another material that is nonreactive with concrete and dimensionally stable to produce continuous and true precast concrete surfaces within fabrication tolerances and suitable for required finishes

C. Form Liners: Units of face design, texture, arrangement, and configuration indicated.

2.02 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 deformed.

B. Steel Bar Mats: ASTM A 184/A 184M, assembled with clips, as follows:

C. Steel Reinforcement: [ASTM A 615/A 615M, Grade 60, deformed bars.

D. Plain-Steel Wire: ASTM A 82, as drawn.

E. Deformed-Steel Wire: ASTM A 496.

F. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

G. Deformed-Steel Welded Wire Fabric: ASTM A 497, flat sheet.

H. Supports: Manufacturer's bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place according to CRSI's "Manual of Standard Practice," PCI MNL 117, and as follows:

2.03 PRESTRESSING TENDONS

A. Prestressing Strand: ASTM A 416/A 416M, Grade 250 or 270, uncoated, 7-wire, low- relaxation strand.

2.04 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I or Type III, [gray] [and] [white], of same type, brand, and source.

1. Standard gray portland cement may be used for non-exposed backup concrete.

B. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C 33, with coarse aggregates complying with Class 5S.

1. Face-Mix Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining.

a. Gradation: [Uniformly graded] [Gap graded] [To match design reference sample].

2. Face-Mix Fine Aggregates: Selected, natural or manufactured sand of the same material as coarse aggregate, unless otherwise approved by Owner's Representative.

C. Lightweight Aggregates: ASTM C 330.

D. Coloring Admixture: ASTM C 979, synthetic mineral-oxide pigments or colored water- reducing admixtures, temperature stable, nonfading, and alkali resistant.

E. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.

F. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

2.05 STEEL CONNECTION MATERIALS

A. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.

B. Carbon-Steel Headed Studs: ASTM A 108, AISI 1018 through AISI 1020, cold finished; AWS D1.1, Type A or B, with arc shields.

C. Carbon-Steel Plate: ASTM A 283/A 283M.

D. Malleable Steel Castings: ASTM A 47.

E. Carbon-Steel Castings: ASTM A 27/A 27M, Grade 60-30.

F. High-Strength, Low-Alloy Structural Steel: ASTM A 572/A 572M.

G. Carbon-Steel Structural Tubing: ASTM A 500, Grade B.

H. Wrought Carbon-Steel Bars: ASTM A 675/A 675M, Grade 65

I. Deformed-Steel Wire or Bar Anchors: ASTM A 496 or ASTM A 706/A 706M.

J. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A; carbon-steel, hex-head bolts and studs; carbon-steel nuts; and flat, unhardened steel washers.

K. High-Strength Bolts and Nuts: ASTM A 325, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers.

L. Shop-Primed Finish: Prepare surfaces of nongalvanized steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP 3 and shop-apply lead-and chromate-free, rust-inhibitive primer, complying with performance requirements in FS TT-P-664 according to SSPC-PA 1.

M. Reglets: As specified.

N. Welding Electrodes: Comply with AWS standards.

O. Accessories: Provide clips, hangers, plastic shims, and other accessories required to install precast architectural concrete units.

2.06 STAINLESS-STEEL CONNECTION MATERIALS

A. Stainless-Steel Plate: ASTM A 666, Type 304, of grade suitable for application.

B. Stainless-Steel Bolts and Studs: ASTM F 593, alloy 304 or 316, hex-head bolts and studs; stainless-steel nuts; and flat, stainless-steel washers.

C. Stainless-Steel Headed Studs: ASTM A 276.

2.07 BEARING PADS

A. Provide bearing pads for precast architectural concrete units as follows:

1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100% polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 Shore A durometer, minimum tensile strength 2250 psi per ASTM D 412.

2. Random-Oriented, Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. Surface hardness of 70 to 90 Shore A durometer.

3. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric bonded to an elastomer. Surface hardness of 80 to 100 Shore A durometer.

4. Frictionless Pads: Tetrafluoroethylene, glass-fiber reinforced, bonded to mild- steel plate, of type required for in-service stress.

5. High-Density Plastic: Multimonomer, nonleaching, plastic strip.

2.08 GROUT MATERIALS

A. Sand-Cement Grout: Portland cement, ASTM C 150, Type I, and clean, natural sand, ASTM C 144. Mix at ratio of 1 part cement to 2-½ parts sand, by volume, with minimum water required for placement and hydration.

B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, of consistency suitable for application.

2.09 INSULATED PANEL ACCESSORIES

A. Extruded-Polystyrene Board Insulation: Rigid, cellular polystyrene thermal insulation formed from polystyrene base resin by an extrusion process using HCFCs as blowing agents; square edged; complying with ASTM C 578, Type IV, 1.6-lb/cu. ft. (26-kg/cu. m) minimum density.

B. Polyisocyanurate Board Insulation: Rigid, cellular polyisocyanurate thermal insulation with core formed by using HCFCs as blowing agents; square edged; complying with ASTM C 1289, Type II, with nonasphaltic facers.

C. Noncomposite Wythe Connectors: Glass-fiber and vinyl-ester polymer connectors, polypropylene pin connectors, or stainless-steel pin connectors manufactured to connect wythes of precast concrete panels without shear transfer.

2.10 CONCRETE MIXES

A. Prepare design mixes for each type of concrete required.

B. Design mixes may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast architectural concrete fabricator's option.

C. Limit water-soluble chloride ions to the maximum percentage by weight of cement permitted by ACI 318.

D. Normal-Weight Concrete Face and Backup Mixes: Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 5000 psi (34.5 MPa).
2. Maximum Water-Cementitious Materials Ratio: 0.45.

E. Water Absorption: 12 to 14% by volume, tested according to PCI MNL 117.

F. Lightweight Concrete Backup Mixes: Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.2, with materials to be used on Project, to provide lightweight concrete with the following properties:

1. Compressive Strength (28 Days): 5000 psi.
2. Unit Weight: Calculated equilibrium unit weight of 115 lb/cu. ft., plus or minus 3 lb/cu. ft., according to ASTM C 567.

G. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.

H. When included in design mixes, add other admixtures to concrete mixes according to manufacturer's written instructions.

2.11 MOLD FABRICATION

A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing operations.

1. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during concreting. Coat form liner with form-release agent.

B. Maintain molds to provide completed precast architectural concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.

1. Edge and Corner Treatment: Uniformly [chamfered] [radiused].

2.12 FABRICATION

A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.

B. Furnish loose steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing precast architectural concrete units to supporting and adjacent construction.

C. Cast-in reglets, slots, holes, and other accessories in precast architectural concrete units to receive windows, cramps, dowels, reglets, waterstops, flashings, and other similar work as indicated.

D. Cast-in openings larger than 10” in any dimension.

E. Reinforcement: Comply with recommendations in CRSI's "Manual of Standard Practice" and PCI MNL 117 for fabricating, placing, and supporting reinforcement.

1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete.

2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.

3. Place reinforcement to maintain at least ¾” minimum coverage. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.

4. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

F. Reinforce precast architectural concrete units to resist handling, transportation, and erection stresses.

G. Prestress tendons for precast architectural concrete units by either pretensioning or posttensioning methods. Comply with PCI MNL 117.

1. Delay detensioning or posttensioning of precast, prestressed architectural concrete units until concrete has reached its indicated minimum design release compressive strength as established by test cylinders cured under the same conditions as concrete.

H. Mix concrete according to PCI MNL 117 and requirements in this Section. After concrete batching, no additional water may be added.

I. Place face mix to a minimum thickness after consolidation of the greater of 1” or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover.

J. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units. Comply with requirements in PCI MNL 117 for measuring, mixing, transporting, and placing concrete.

1. Place backup concrete to ensure bond with face mix concrete.

K. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items. Use equipment and procedures complying with PCI MNL 117.

L. Comply with ACI 306.1 procedures for cold-weather concrete placement.

M. Comply with ACI 305R recommendations for hot-weather concrete placement.

N. Identify pickup points of precast architectural concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each precast architectural concrete unit on a surface that will not show in finished structure.

O. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture.

P. Discard precast architectural concrete units that are warped, cracked, broken, spalled, stained, or otherwise defective unless repairs are approved by Owner's Representative.

2.13 INSULATED PANEL CASTING

A. Cast and screed supported wythe over mold.

B. Immediately place insulation boards, abutting edges and ends of adjacent boards. Stagger end joints between rows. Stagger joints of insulation layers one-half board apart. Insert wythe connectors through predrilled insulation, and consolidate concrete around connectors according to connector manufacturer's written instructions.

C. Cast and screed structural wythe and apply initial float finish.

2.14 FABRICATION TOLERANCES

A. Fabricate precast architectural concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished panel complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.

2.15 FINISHES

A. Finish exposed-face surfaces of precast architectural concrete units to match approved [design reference sample] [sample panels] [or] [mockups] and as follows:

1. Design Reference Sample:
2. PCI and APA's "Architectural Precast Concrete-Color and Texture Selection Guide," of plate numbers indicated.
3. Provide surfaces free of pockets, sand streaks, and honeycombs, with uniform color and texture.
4. Textured-Surface Finish: Impart by form liners or inserts to provide surfaces free of pockets, streaks, and honeycombs, with uniform color and texture.
5. Bushhammer Finish: Use power or hand tools to remove matrix and fracture coarse aggregates.
6. Retarded Finish: Use chemical retarding agents applied to concrete forms and washing and brushing procedures to expose aggregate and surrounding matrix surfaces after form removal.
7. Abrasive-Blast Finish: Use abrasive grit, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces.
8. Acid-Etched Finish: Use acid and hot-water solution, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces.
9. Honed Finish: Use continuous mechanical abrasion with fine grit, followed by filling and rubbing procedures.
10. Polished Finish: Use continuous mechanical abrasion with fine grit, followed by filling and rubbing procedures.
11. Sand-Embedment Finish: Use selected stones placed in a sand bed in bottom of mold, with sand removed after curing.

B. Finish exposed surfaces of precast architectural concrete units to match face-surface finish.

C. Finish exposed surfaces of precast architectural concrete units by smooth, steel-trowel finish.

D. Finish unexposed surfaces of precast architectural concrete units by float finish.

2.16 SOURCE QUALITY CONTROL

A. Owner will employ an independent testing agency to evaluate precast architectural concrete fabricator's quality-control and testing methods.

1. Allow Owner's testing agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with Owner's testing agency and provide samples of materials and concrete mixes as may be requested for additional testing and evaluation.

B. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 117 requirements.

C. Strength of precast concrete units will be considered deficient if units fail to comply with ACI 318 requirements.

D. Testing: If there is evidence that the strength of precast concrete units may be deficient or may not comply with ACI 318 (ACI 318M) requirements, Owner will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42.

1. A minimum of three representative cores will be taken from units of suspect strength, from locations directed by Owner's Representative.
2. Cores will be tested in an air-dry condition.
3. Strength of concrete for each series of 3 cores will be considered satisfactory if the average compressive strength is equal to at least 85% of the 28-day design compressive strength and no single core is less than 75% of the 28-day design compressive strength.
4. Test results will be made in writing on the same day that tests are performed, with copies to Owner's Representative, Contractor, and precast concrete fabricator. Test reports will include the following:
    a. Project identification name and number.
    b. Date when tests were performed.
    c. Name of precast concrete fabricator.
    d. Name of concrete testing agency.
    e. Identification letter, name, and type of precast concrete unit or units represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.

E. Patching: If core test results are satisfactory and precast concrete units comply with requirements, clean and dampen core holes and solidly fill with precast concrete mix that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.

F. Defective Work: Precast architectural concrete units that do not comply with requirements, including strength, manufacturing tolerances, and finishes, are unacceptable. Replace with precast concrete units that comply with requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Do not install precast concrete units until supporting concrete has attained minimum design compressive strength.

3.02 INSTALLATION

A. Install clips, hangers, and other accessories required for connecting precast architectural concrete units to supporting members and backup materials.

B. Install precast architectural concrete. Provide temporary supports and bracing as required to maintain position, stability, and alignment as units are being permanently connected.

1. Install bearing pads as precast concrete units are being erected.
2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
3. Remove projecting hoisting devices and use sand-cement grout to fill voids within recessed hoisting devices flush with surface of concrete.

C. Anchor precast architectural concrete units in position by bolting, welding, grouting, or as otherwise indicated. Remove temporary shims, wedges, and spacers as soon as possible after anchoring and grouting are completed.

D. Welding: Perform welding in compliance with AWS D1.1 and AWS D1.4, with qualified welders.

1. Protect precast architectural concrete units and bearing pads from damage by field welding or cutting operations and provide noncombustible shields as required.
2. Repair damaged steel surfaces by cleaning and applying a coat of galvanizing repair paint to galvanized surfaces.
3. Repair damaged steel surfaces by cleaning and repriming damaged painted surfaces.

E. At bolted connections, use lock washers or other acceptable means to prevent loosening of nuts.

F. Grouting Connections: Grout connections where required or indicated. Retain grout in place until hard enough to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout to finish smooth, level, and plumb with adjacent concrete surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.

3.03 ERECTION TOLERANCES

A. Install precast architectural concrete units level, plumb, square, true, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 117, Appendix I.

B. Install precast architectural concrete units level, plumb, square, and true, without exceeding the following noncumulative erection tolerances.

1. Plan Location from Building Grid Datum: Plus or minus ½”.
2. Plan Location from Centerline of Steel: Plus or minus ½”.
3. Top Elevation from Nominal Top Elevation: As follows:
    a. Exposed Individual Panel: Plus or minus ¼”.
    b. Nonexposed Individual Panel: Plus or minus ½”.
    c. Exposed Panel Relative to Adjacent Panel: ¼”.
    d. Nonexposed Panel Relative to Adjacent Panel: ½”.
4. Support Elevation from Nominal Support Elevation: As follows:
    a. Maximum Low: ½”.
    b. Maximum High: ¼”.
5. Maximum Plumb Variation over the Lesser of Height of Structure or 100’: 1”.
6. Plumb in Any 10’ of Element Height: ¼”.

7. Maximum Jog in Alignment of Matching Edges: ¼”.
8. Joint Width (Governs over Joint Taper): Plus or minus ¼”.
9. Maximum Joint Taper: ⅜”.
10. Joint Taper in 10’: ¼”.
11. Maximum Jog in Alignment of Matching Faces: ¼”.
12. Differential Bowing or Camber, as Erected, between Adjacent Members of Same Design: ¼”.

3.04 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections.

B. Field welds and connections using high-strength bolts will be subject to tests and inspections.

C. Testing agency will report test results promptly and in writing to Contractor and Owner's Representative.

D. Remove and replace work that does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.05 REPAIRS

A. Repair exposed exterior surfaces of precast architectural concrete units to match color, texture, and uniformity of surrounding precast architectural concrete if permitted by Owner.

B. Remove and replace damaged precast architectural concrete units if repairs do not comply with requirements.

3.06 CLEANING

A. Clean exposed surfaces of precast concrete units after erection to remove weld marks, other markings, dirt, and stains.

1. Wash and rinse according to precast concrete fabricator's written recommendations. Protect other work from staining or damage due to cleaning operations.
2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes.

END OF SECTION

SECTION 03 5216
LIGHTWEIGHT INSULATING CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. Related Sections:

1. 03 3000 - Cast-In-Place Concrete.
2. 05 3113 - Steel Floor Decking.
3. 05 3123 - Steel Roof Decking.
4. 07 5100 - Built-Up Bituminous Roofing.
5. 07 5113 - Built-Up Asphalt Roofing
6. 07 6200 - Flashing and Sheet Metal.
7. Division 22 - Drains, Floor Sinks, and Cleanouts.

1.02 REFERENCES AND CODES

A. American Society for Testing and Materials (ASTM):

1. A653/A-96: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip process.
2. C138-92: Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.
3. C150-96: Specification for Portland Cement.
4. C177-85(93): Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot- Plate Apparatus.
5. C332-87(91): Specification for Lightweight Aggregates for Insulating Concrete.
6. C495-91a: Test Method for Compressive Strength of Lightweight Insulating Concrete.
7. C513-89(95) Test Method for Obtaining and Testing Specimens of Hardened Lightweight Insulating Concrete for Compressive Strength.
8. C518-91: Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
9. C578-95: Specification for Rigid, Cellular Polystyrene Thermal Insulation.
10. C869-91: Specification for Foaming Agents Used in Making Preformed Foam for Cellular Concrete.

B. Underwriters Laboratories (UL) for Class A fire resistance.

1.03 SUBMITTALS

A. Product Data: Submit for each product required and application instructions.

B. Shop Drawings: Provide roof plan showing roof slopes, thickness of insulation, roof penetrations, and specific details required for project installation.

C. Submit samples of insulation board.

D. Quality control submittals:

1. Laboratory results for Thermal Resistance Values based on ASTM C177 or C518.
2. Wind Resistance Classification.
3. Current affidavit from insulating concrete manufacturer approving applicator before installation.

4. UL listing.

1.04 QUALITY ASSURANCE

A. Comply with the Prince George's County building code.

B. Insulating cellular concrete shall be applied by a manufacturer's certified applicator.

C. Any excess water on the lightweight concrete shall be removed before roof installation by vacuuming, evaporation, or other method complying with membrane manufacturer's requirements.

D. Applicator shall maintain a job log for submittal to A/E. The job log shall contain cast density recordings taken at a minimum interval of 1 hour.

1. Cast densities shall be measured with a calibrated scale measuring from 1 to 50 pounds in increments of 1/4 pound and be accurately calibrated to 1/16 pound.

2. The measuring bucket shall be 5 quarts or larger.

3. Measurements shall be taken according to ASTM C138.

E. A "Walkability Inspection" by the A/E and the Board shall determine the lightweight insulating concrete installation as a satisfactory substrate.

1. If the installation fails the inspection, additional testing shall be required by the A/E to confirm fastener spacing or provide data for the roof system manufacturer to calculate a new fastener pattern.

a. Fastener testing shall be required.

b. Any areas where fasteners will not hold a minimum of 40 pounds after 5 days of cure shall be removed and recast.

F. If continued noncompliance is observed and the roof deck and associated roof system cannot be corrected based on additional testing and attachment calculations, the nonconforming lightweight shall be removed and recast.

G. If a denser fastener pattern is required for elevated pressure zones, a Maryland registered professional engineer shall recalculate perimeter and corner spacing.

H. Field withdrawal resistance testing of lightweight concrete fasteners shall be conducted.

1. The average withdrawal resistance values obtained in field testing shall be within 10 percent of the values listed in the Roof Assemblies Limitations.

2. If the values are not achieved, a Maryland registered professional engineer can recalculate the fastener density.

I. Roofing Contractor shall consult with roofing system manufacturer for compatibility with all surface coatings or treatments.

J. Direct-adhered single ply systems shall be installed in strict compliance with manufacturer's specifications.

K. All coatings or surface preparation materials applied to the lightweight concrete shall be listed as an approved interface material with the roof membrane manufacturer.

L. Topping applied over insulation boards and any decking/substrate that allows deflection under normal traffic shall be installed within 4 hours of board installation.

1. If installation is interrupted due to inclement weather or other situations beyond the control of the contractor, the installed insulation board shall be inspected to confirm adhesion to the substrate.

2. Over solid substrates, topping installation shall not be delayed over 24 hours.

M. Roof Membrane Application: Contractor shall coordinate commencement of roofing over the lightweight insulating concrete after satisfactorily passing fastener pullout test.

N. Conduct pre-roofing conference before the installation of the roof insulation with A/E and representatives from manufacturer of insulating concrete, roofing membrane materials, and all other related trades in attendance. At the meeting date determined, by mutual agreement, between parties concerned.

O. Oven-Dry Density: Determine according to Section 7 of Test for Compressive Strength of Lightweight Insulating Concrete, ASTM C495.

P. Compressive Strength: Determine compressive strength according to requirements of ASTM C495.

1.05 DELIVERY AND STORAGE

A. Deliver material in manufacturer's original undamaged packages or acceptable bulk containers.

B. Store packaged material to protect them from the elements or physical damage.

C. Do not use cement that shows indications of moisture damage, caking, or other signs of deterioration.

1.06 WARRANTY

A. Warrant to the Board that for 10 years from the date of the completion of the lightweight insulating concrete that:

1. The roof insulation system shall remain in a reroofable condition should the roof membrane require replacement.
2. The actual resistance to heat flow through the roof insulation system shall be at least 80 percent of design thermal resistance.
3. The roof insulation will remain in place even if the roof membrane sustains wind damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Insulating Concrete:

1. Concrecel by Concrecel International.
2. Cellular Hybrid by Elastizell.
3. NVS (Non-Vented Substrate) by Siplast.
4. Zonocel by Siplast.
5. Insulcel by Siplast.

2.02 MATERIALS

A. Insulating Concrete Physical Properties:

1. Portland cement and pregenerated foam with water:
   a. Wet density at point of placement: 42-50 pcf.
   b. Minimum oven dry density: 32-40 pcf.
   c. Minimum compressive strength: 300 psi.
2. Portland cement and vermiculite concrete with water(1:3.5):
   a. Wet density at point of placement: 60-68 pcf.
   b. Minimum oven dry density: 35 pcf.
   c. Minimum compressive strength: 300 psi.

B. Insulation Board: One pound density expanded polystyrene board with 25 to 35 bonding and venting slots. Deliver each bundle of 2 foot by 4 foot boards to the job site with clear identification as to the manufacturer and shall carry the FM approval label on each bundle.

C. Portland Cement shall comply with ASTM C150, Type I, II, or III.

D. Water: Potable, clean, maximum chloride level of 250 ppm, and free from deleterious amount of acid, alkali, and organic material.

E. Foaming agent: Liquid concentrate shall be manufactured and be delivered to the job site with clear identification as to manufacturer and type of material according to ASTM C869.

F. Admixtures shall not be used unless specifically recommended by the manufacturer.

G. Mesh Reinforcement: Keydeck style 2160-2-1619 galvanized mesh or equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Surfaces to receive insulating concrete shall be sound, free of loose material, and free from defects affecting application.

B. Installation of other work passing through fill or concealed shall be complete and accepted before starting the work.

C. The applicator shall be responsible for inspection and approval of the substrate as suitable for roof insulation.

D. Installation of curbs, equipment supports, roof drains, framing for openings, and wood nailers shall be in place before application of material.

E. Poured Surface Finish:

1. Surface shall be bonded firmly and free from loose materials.
2. Screeded finish of surface shall be free from extreme roughness capable of interfering with proper bonding of roofing membrane and free from shrinkage and cracks.
3. Surface Dryness: Exposed surface shall look and feel substantially dry, and shall have a uniformly gray cement color.

3.02 INSTALLATION

A. Slurry: Cover substrate with a 1/8" slurry coat of the lightweight insulating fill.

B. Insulation Board:

1. Place insulation board in the 1/8" slurry coat.
2. Insulation board placement shall be made within 30 minutes of slurry coat placement.
3. Place insulation board in a manner that provides full contact of slurry to board.
4. Lay insulation board in brick paver pattern with joints staggered and side and end joints butted snugly.
5. Under no circumstances shall insulation board be laid dry on substrate.
6. Remove loose boards and immediately re-grout.

C. Lightweight Insulating Fill:

1. Within 24 hours of insulation board placement, place a minimum of 2 inches of lightweight insulating fill over the insulation board and screed to an even surface to receive the roofing membrane.

2. Increase thickness as required at 1/4" per foot slope to obtain roof drainage slopes as indicated on Drawings.
3. Roof Crickets: At roof low points between roof drains, between roof drains and parapets and at high side of fan curbs, provide insulation concrete crickets uniformly sloped not less than 1/2" per foot.

D. Installed system shall achieve a minimum average R-value of 20.

3.03 QUALITY CONTROL

A. Check the cast density according to ASTM C869 hourly at the point of placement.

B. Testing: Make set of 4 standard cylinders of each day's mix and text according to ASTM C495. When more than 75 cubic yards of concrete are poured in 1 day, make a set of specimens of each 75 yards.

C. Drainage Test: After initial set, provide hose test to assure proper drainage slopes with no ponding.

3.04 PROTECTION

A. Do not expose insulating concrete to prolonged exposure to the elements more than 7 days.

B. Do not use as a temporary working surface without adequate surface protection, nor allow it to function as a temporary dry in.

C. Prevent traffic on roof deck until applicator allows such traffic.

END OF SECTION

SECTION 03 5400
CAST UNDERLAYMENT

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 01 7000 - Execution and Closeout Requirements: Alteration project procedures; selective demolition for remodeling.

1.02 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens) 2016a.

B. ASTM C150/C150M - Standard Specification for Portland Cement 2018.

C. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete 2012.

D. ASTM C348 - Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars 2014.

E. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete 1999 (Reapproved 2014).

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2018b.

1.03 SUBMITTALS

A. Product Data: Provide manufacturer's data sheets documenting physical characteristics and product limitations of underlayment materials. Include information on surface preparation, environmental limitations and installation instructions.

B. Provide evidence of applicator's qualifications.

C. Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer's Instructions.

1.04 QUALITY ASSURANCE

A. Installation of the underlayment shall be by an applicator approved by the manufacturer, who shall have had a minimum of five years successful experience in applying the underlayment to the types of substrates indicated on the drawings.

B. Mixing equipment, tools and other accessories shall be types approved by the underlayment manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Keep dry and protect from direct sun exposure, freezing, and ambient temperature greater than 105 degrees F (41 degrees C).

C. Deliver materials in original, unopened packaging. Protect from exposure to moisture, freezing temperatures, and direct exposure to sunlight. Store in a manner to prevent damage of disturbance of materials until ready for use.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cast Underlayments, General:

1. Comply with applicable code for combustibility or flame spread requirements.

B. Gypsum-Based Underlayment: Gypsum based mix, that when mixed with water in accordance with manufacturer's directions will produce self-leveling underlayment with the following properties:

1. Compressive Strength: Minimum 2500 pounds per square inch (17.24 MPa), tested per ASTM C472.
2. Final Set Time: 1 to 2 hours, maximum.
3. Thickness: 3/4 inch (19 mm) to maximum 3-1/2 inch (89 mm).
4. Surface Burning Characteristics: Flame spread/Smoke developed index of 0/0 in accordance with ASTM E84.

C. Cementitious Underlayment:

1. Blended cement mix, that when mixed with water in accordance with manufacturer's directions will produce self-leveling underlayment with the following properties:
   a. Cement based, with a blend of Calcium Aluminate Cement and Portland cement binder.
   b. Flowing Time: Approximately 10 minutes at 70 degrees F
   c. Initial Set: Approximately 30 minutes at 70 degrees F (ASTM C191)
   d. Final Set: Approximately two (2) hours at 70 degrees F (ASTM C191)
   e. Compressive Strength: Minimum [2630] pounds per square inch ([4100] MPa) after 28 days, tested per ASTM C109/C109M.
   f. Flexural Strength: Minimum 1000 psi (6.9 MPa) after 28 days, tested per ASTM C348.
   g. Density: 125 pounds per cubic foot (2002 kg/cu m), nominal.
   h. Thickness: Capable of thicknesses from feather edge to maximum 3-1/2 inch (89 mm).
   i. Surface Burning Characteristics: Flame spread/Smoke developed index of 0/0 in accordance with ASTM E84.

D. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to underlayment mix materials.

E. Primer: Manufacturer's recommended type.

F. Joint and Crack Filler: Latex based filler, as recommended by manufacturer.

G. Sound Control Mat: Sheet material, perimeter isolation strip, and tape; as recommended by the underlayment manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are clean, dry, unfrozen, do not contain petroleum byproducts, or other compounds detrimental to underlayment material bond to substrate.

3.02 PREPARATION

A. Thoroughly inspect all surfaces prior to application of the underlayment, in order to identify and correct conditions, which would affect both application and performance. Coordinate installation of underlayment with the work of other trades.

B. All surfaces shall be solid, intact, clean and properly primed.

1. All concrete subflooring shall have reached specified design strength, shall be clean and free of oil, grease, dirt, curing compounds, or any other substance which may act as a bond break between the subfloor and the underlayment. Do not use acid etching as a means of removing such substances.

2. Non-porous surfaces such as ceramic tile and quarry tile shall be clean and free of all wax and sealers.
3. Repair cracks in the subfloor to minimize "telegraphing" of crack into underlayment.

C. Install sound control mat in accordance with manufacturer's instructions.

3.03 APPLICATION

A. Priming

B. Installation

1. Install underlayment in accordance with manufacturer's instructions.
2. Mixing Ratios: Following manufacturer's recommendations for bag: water ratio. Mix thoroughly to eliminate lumps and to provide even consistency.
3. Mix aggregates in recommended proportions where thickness is to exceed 1 1/2". Do not use sand as an aggregate.
4. Pour or pump underlayment and spread in place using recommended spreader. Use recommended smoother for feather edging and touch up. Installers shall wear cleated baseball footwear to avoid leaving marks in the liquid underlayment.
5. Allow underlayment to dry (per manufacturers tech data sheets) for at least two (2) hours at 70o F before accepting foot traffic.
6. Do not apply finished floor until underlayment has been in place for at least 16 hours.
7. Extend isolation and control joints through the underlayment.
8. Once application is complete, remove all excess materials, tools, trash and other debris associated with the work of this Section from the premises and dispose of legally. Clean adjacent surfaces in order to remove excess material or splatters.

END OF SECTION

SECTION 03 6200
NON SHRINK GROUTING

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Procedures for testing, inspection, mock-ups, reports, certificates; use of reference standards.

B. Drawings and General Provisions of Contract, including General Conditions and other Division 1 Specification Sections, apply to the Work of this Section.

1.02 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength

B. ASTM C827/C827M - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures

1.03 QUALITY ASSURANCE

PART 2 PRODUCTS

2.01 GENERAL

A. Non-shrink grout shall consist of premeasured, prepackaged materials supplied by the manufacturer requiring only the addition of water. The manufacturer's instructions must be printed on the outside of each bag.

2.02 NONSHRINK CEMENT-BASED GROUT

A. The contractor shall submit information verifying that the grout exhibits the following:

1. Nonshrink: No shrinkage (0.0%) and a maximum 4.0% expansion when tested in accordance with ASTM C-827. No shrinkage (0.0%), and a maximum of 0.2% expansion in the hardened state when tested in accordance with CRD-C-621.
2. Compressive Strength: A minimum 28-day compressive strength of 5,000 psi when tested in accordance with ASTM C-109.
3. Setting Time: A minimum set time of 60 minutes when tested in accordance with ASTM C-191.
4. Technical Service: The manufacturer shall provide technical service upon request.
5. Composition: For column base plates, grout containing metallic particles such as aluminum powders or iron fillings may be used. For any other applications, the grout shall not contain metallic particles or expansive cement.

2.03 WATER

A. Drinkable water shall be used in mixing grout. Use the minimum water necessary for proper installation in accordance with flowability requirements and manufacturers recommendations for specific applications.

2.04 SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Coordination of Other Tests and Inspections: Owner will employ independent testing agency to test and/or inspect items as required by project; provide access as required to accommodate timely performance.

PART 3 EXECUTION

3.01 GENERAL

A. Placing: The Contractor shall perform all mixing, grouting, and curing in accordance with the manufacturer's recommendations.

B. Temperature: The temperature of the grouting surfaces and the grout shall be maintained between 50 degrees F and 90 degrees F during grouting and for a minimum of 24 hours thereafter.

C. Elimination of Voids: Grout placement shall proceed in a manner that will assure the filling of all spaces and intimate contact of the grout with contact surfaces. Grout holes shall be used; location to be approved by Architect/Engineer if not otherwise detailed.

3.02 SURFACE PREPARATION

A. Concrete Surfaces:

1. The concrete on which the grout will bear shall have attained its design strength before grouting.
2. Concrete shall be sound and all surfaces to be in contact with the grout shall be entirely free of oil, grease, laitance, curing compounds, and other deleterious substances.
3. Surfaces shall be roughened by chipping, sandblasting or other mechanical means to assure bond of the grout to the existing concrete.
4. Concrete surfaces shall be washed clean, then saturated with water for 24 hours prior to placement of cement-based grout. Excess water must be removed prior to grouting.

B. Metal Surfaces: All metal surfaces, which are to be in direct contact with the grout, shall be thoroughly cleaned to bare metal immediately before grouting.

3.03 GROUT REMOVAL

A. Treat adjacent surfaces and formwork with a bond breaking material to prevent bonding of excess grout.

END OF SECTION

SECTION 04 0511
MORTAR AND MASONRY GROUT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Mortar for masonry.

B. Grout for masonry.

1.02 RELATED REQUIREMENTS

A. Section 04 0100 - Maintenance of Masonry: Bedding and pointing mortar for masonry restoration work.

B. Section 04 2000 - Unit Masonry: Installation of mortar and grout.

1.03 REFERENCE STANDARDS

A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries 2013.

B. ASTM C5 - Standard Specification for Quicklime for Structural Purposes 2018.

C. ASTM C91/C91M - Standard Specification for Masonry Cement 2012.

D. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar 2017.

E. ASTM C150/C150M - Standard Specification for Portland Cement 2018.

F. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes 2018.

G. ASTM C270 - Standard Specification for Mortar for Unit Masonry 2014a.

H. ASTM C387/C387M - Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar 2015.

I. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry 2018a.

J. ASTM C1142 - Standard Specification for Extended Life Mortar for Unit Masonry 1995 (Reapproved 2013).

1.04 SUBMITTALS

A. Product Data: Include design mix and indicate whether the Proportion or Property specification of ASTM C270 is to be used. Also include required environmental conditions and admixture limitations.

1.05 QUALITY ASSURANCE

A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of the contract documents.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.07 FIELD CONDITIONS

A. Cold and Hot Weather Requirements: Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

2.01 MORTAR AND GROUT APPLICATIONS

A. At Contractor's option, mortar and grout may be field-mixed from packaged dry materials, made from factory premixed dry materials with addition of water only or ready-mixed.

2.02 MATERIALS

A. Portland Cement: ASTM C150,Type 1.

B. Masonry Cement: ASTM C91.

C. Aggregates: Standard masonry type, ASTM C144, clean, dry and protected against dampness, freezing and foreign matter.

D. Hydrated Lime: Conforming to requirements of ASTM C207, Type S.

E. Quicklime: Non-hydraulic type, ASTM C5.

F. Premix Mortar: Commercially prepared type, ASTM C387:

1. Below grade: Type M.

2. Above grade: Type S.

G. Premix Mortar with Color Additive: ASTM C387, Type S, color as selected by Architect. For additions to existing buildings, match existing mortar, as approved in writing by Architect.

1. “Flamingo-Brixment”, ESSROC Cement Corporation, Nazareth, PA 1- 610-837-6725 (www.essroc.com)

2. Lehigh Cement Co., Allentown, PA, 1-800-523-5488.

H. Water: Clean and free from injurious amounts of oil, alkali, organic matter or other deleterious material.

2.03 MORTAR MIXING

A. Ready Mixed Mortar: ASTM C1142, Type equivalent to that specified according to ASTM C270.

B. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use.

C. Maintain sand uniformly damp immediately before the mixing process.

D. Do not use anti-freeze compounds to lower the freezing point of mortar.

E. If water is lost by evaporation, re-temper only within two hours of mixing.

F. Provide minimum 1800 psi mortar.

G. Accelerators: ASTM C494, Type C; AASHTO M194, Type C. shall not contain calcium chloride; W. R. Meadows "Hydraset-Free" accelerator or comparable.

H. Mortar shall be used within two and one half hours of the initial mix-up at temperatures between 40 degrees F (10 degrees C) and 80 degrees F (26 degrees C) and within two hours of mixing at temperatures over 80 degrees F (26 degrees C). It shall not be used after it has begun to set.

PART 3 EXECUTION

3.01 PREPARATION

A. Apply bonding agent to existing concrete surfaces.

B. Plug clean-out holes for grouted masonry with brick masonry units. Brace masonry to resist wet grout pressure.

3.02 INSTALLATION

A. Install mortar and grout to requirements of section(s) in which masonry is specified.

3.03 GROUTING

A. Use either high-lift or low-lift grouting techniques, at Contractor 's option, subject to other limitations of contract documents.

B. Do not use high-lift grouting where size of cavities mandates use of fine grout.

C. Low-Lift Grouting:

1. Limit height of pours to 12 inches (300 mm).
2. Limit height of masonry to 16 inches (400 mm) above each pour.
3. Pour grout only after vertical reinforcing is in place; place horizontal reinforcing as grout is poured. Prevent displacement of bars as grout is poured.
4. Place grout for each pour continuously and consolidate immediately; do not interrupt pours for more than 1-1/2 hours.

D. High-Lift Grouting:

1. Verify that horizontal and vertical reinforcement is in proper position and adequately secured before beginning pours.
2. Place grout for spanning elements in single, continuous pour.

3.04 FIELD QUALITY CONTROL

A. An independent testing agency will perform field tests, in accordance with provisions of Section 01 4000 - Quality Requirements.

B. Test and evaluate mortar in accordance with ASTM C780 procedures.

END OF SECTION

SECTION 04 2000
UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete block.

B. Concrete building brick.

C. Concrete facing brick.

D. Clay facing brick.

E. Common brick.

F. Reinforcement and anchorage.

G. Flashings.

H. Lintels.

I. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 1000 - Concrete Forming and Accessories: Dovetail slots for masonry anchors.

B. Section 03 2000 - Concrete Reinforcing: Reinforcing steel for grouted masonry.

C. Section 03 3000 - Cast-in-Place Concrete: Installation of dovetail slots for masonry anchors.

D. Section 04 0511 - Mortar and Masonry Grout.

E. Section 07 2100 - Thermal Insulation: Insulation for cavity spaces.

F. Section 07 2123 - Loose-Fill Insulation: Granular insulation for masonry unit cores.

G. Section 07 8400 - Firestopping: Firestopping at penetrations of fire-rated masonry and at top of fire-rated walls.

H. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2018, with Editorial Revision (2018).

C. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement 2016.

D. ASTM C55 - Standard Specification for Concrete Building Brick 2017.

E. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units 2016a.

F. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units 2017.

G. ASTM C140/C140M - Standard Test Methods of Sampling and Testing Concrete Masonry Units and Related Units 2017a.

H. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar 2017.

I. ASTM C150/C150M - Standard Specification for Portland Cement 2018.

J. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes 2018.

K. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale) 2017a.

L. ASTM C270 - Standard Specification for Mortar for Unit Masonry 2014a.

M. ASTM C404 - Standard Specification for Aggregates for Masonry Grout 2011.

N. ASTM C476 - Standard Specification for Grout for Masonry 2018.

O. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete 2016.

P. ASTM C1634 - Standard Specification for Concrete Facing Brick 2017.

Q. ASTM D4637/D4637M - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane 2015.

R. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls 2017.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Fire-resistance rated masonry: Comply with requirements for materials and installation established by governing authorities for the construction and fire-resistance rating indicated.

1.05 SUBMITTALS

A. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar and masonry accessories.

1. Shop drawings for masonry reinforcing as indicated on Drawings, detailing fabrication, bending and placement of reinforcing bars.

2. Grout mix design for grout used in reinforced and non-reinforced masonry.

B. Samples:

1. Submit four samples of decorative block units to illustrate color, texture, and extremes of color range.

2. All accessories that shall be embedded in masonry.

C. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

D. Manufacturer's Certificate: Certify that water repellent admixture manufacturer has certified masonry unit manufacturer as an approved user of water repellent admixture in the manufacture of concrete block.

E. Test Reports: Concrete masonry manufacturer's test reports for units with integral water repellent admixture. As a condition of approval, the masonry units listed here shall require the submittal of the following certified test reports:

1. Hollow load-bearing units:

a. ASTM C90-93, for Type 1, moisture controlled units using 8" samples.

b. ASTM C-426-83 for average shrinkage not to exceed .030 using a minimum of three (3) 8" samples. The test report shall indicate shrinkage measurements for each duration period of drying. Testing shall be performed for a minimum total time of 19 days, or until equilibrium is obtained, whichever is greater.

c. ASTM C140-75 indicating absorption characteristics.

2. Hollow non-load bearing units:

a. ASTM C129-85 for Type 1, moisture controlled units using 6" samples.

b. ASTM C426-83 for average shrinkage not to exceed .030 using a minimum of three (3) 6" samples. The test report shall indicate shrinkage measurements for each duration period of

drying. Testing shall be performed for a minimum total time of 19 days, or until equilibrium is obtained whichever is greater.

c. ASTM C140-75 indicating absorption characteristics.

1.06 QUALITY ASSURANCE

A. Cold Weather Protection:

1. Conform to BIA Technical Notes 1, and 1A.
2. Conform to applicable requirements of ACI 530.1.

B. Hot Weather Protection

1. Protect masonry construction from direct exposure to wind and sun when erected in an ambient air temperature of 99 degrees F in shade, with RH less than 50 percent.
2. Conform to applicable requirements of ACI 530.1.

1.07 MOCK-UP

A. Construct a sample panel 5'-4” X 6' minimum on the job site in a location selected by the Architect, and situated such that both interior and exterior faces are clearly visible. Construct panel of selected units representing full color and texture range of both the facing units and the masonry back-up. Panel shall demonstrate cavity wall construction as indicated on the Drawings and Specifications but not limited to the following:

1. solid grouted CMU with reinforcement

B. The approved panel shall be a standard of comparison for all masonry work, and shall serve as a standard of quality for the following criteria:

1. Reasonable uniformity of color and texture for all facing units.
2. Reasonable uniformity of shade and texture for all exposed interior masonry units.
3. Reasonable accuracy for color, thickness and tooling of all mortar joints for both facing units and interior exposed masonry units.
4. Level of workmanship for installation of thru-wall flashing, air barrier and weep holes.
5. Level of workmanship for integrity of cavity air space (free of mortar droppings or other obstructions).
6. No masonry work shall begin until the Architect, in concurrence with the Owner’s Representative, has given approval of the panel in writing.

C. Failure of masonry work to comply with the standards of quality represented by the sample panel may, at the discretion of the Owner’s Representative, give cause for the rejection of that work.

D. The approved sample panel shall remain in place until completion of the project, and shall be demolished and removed from the site upon approval of the Owner’s Representative.

E. Locate where directed.

F. Mock-up may remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

B. Handle and store ceramic glazed masonry units in protective cartons or trays. Do not remove from protective packaging until ready for installation.

C. Units shipped from the manufacturer shall comply with the parameters of Type 1 for moisture content. Units shall be delivered covered and protected from the weather in such a manner as to eliminate contact with excessive moisture.

D. Store units above ground.

E. Store on level platform, which permits air circulation under stack.

F. Cover and protect units from weather, moisture and neglect.

G. Protect anchors, ties, and reinforcement from weather exposure and construction activity.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. General

1. An approved manufacturer is one who has given evidence that the masonry units to be supplied have been tested in accordance with the ASTM specifications listed in this specification (see Quality Assurance). The manufacturer shall have on file with the Owner current certified test reports. Current test reports are defined as those reports performed and dated within twelve (12) months of the bid due date for this project.
2. The manufacturer shall certify, as a condition of approval, that the masonry units supplied for the project shall be a minimum of 30 days old at time of shipment from manufacturer.
3. Provide UL listed units as required for fire resistant ratings indicated, or provide units for masonry assemblies complying with ACI 216.1-97/TMS 0216.1-97 for the fire resistant rating required.
4. Provide Bullnose units as indicated and at all external corners.

B. Concrete Block: Comply with referenced standards and as follows:

1. Size: Standard units with nominal face dimensions of 16 by 8 inches (400 by 200 mm) and nominal depth of 8 inches (200 mm).
2. Load-Bearing Units: ASTM C90, normal weight.
    a. Hollow block, as indicated.
    b. Exposed Faces: Manufacturer's standard color and texture where indicated.
3. Non-Loadbearing Units: ASTM C129.
    a. Hollow block, as indicated.

C. Concrete Brick:

1. Size: As indicated on drawings.
2. Concrete Building Brick: ASTM C55; lightweight, solid, for interior or concealed use.
3. Concrete Facing Brick: ASTM C1634; solid, lightweight; for architectural, paver and below grade use.
    a. Exposed Faces: Color and texture to be selected from manufacturer's standard range.

2.02 BRICK UNITS

A. Manufacturers:

1. Belden Brick; Belcrest: www.beldenbrick.com/#sle.
2. Endicott Clay Products Co; [_____]: www.endicott.com/#sle.

B. Facing Brick: ASTM C216, Type FBS Smooth, Grade SW.

1. Nominal size: As indicated on drawings.
2. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.

2.03 MORTAR AND GROUT MATERIALS

A. Masonry Cement: ASTM C91/C91M, [____].
   1. Colored Mortar: Premixed cement as required to match Architect's color sample.
   2. Manufacturers:
      a. [_____].
      b. [_____].
      c. [_____].
      d. Substitutions: See Section 01 6000 - Product Requirements.

B. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.

C. Hydrated Lime: ASTM C207, Type S.

D. Mortar Aggregate: ASTM C144.

E. Grout Aggregate: ASTM C404.

F. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.

G. Accelerating Admixture: Nonchloride type for use in cold weather.
   1. Manufacturers:
      a. [_____].

H. Moisture-Resistant Admixture: Water repellent compound designed to reduce capillarity.
   1. Manufacturers:

2.04 REINFORCEMENT AND ANCHORAGE

A. Manufacturers:
   1. Blok-Lok Limited; [_____]: www.blok-lok.com/#sle.
   2. Hohmann & Barnard, Inc; X-Seal Anchor: www.h-b.com/#sle.
   3. [_____].
   4. [_____].
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Reinforcing Steel: Type [_____] , as specified in Section 03 2000; size as indicated on drawings; galvanized finish.

C. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.

D. Single Wythe Joint Reinforcement: ASTM A951/A951M.
   1. Type: Truss or ladder.
   2. Material: ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M Class 3.

3. Size: 0.1483 inch (3.8 mm) side rods with 0.1483 inch (3.8 mm) cross rods; width as required to provide not less than 5/8 inch (16 mm) of mortar coverage on each exposure.

E. Multiple Wythe Joint Reinforcement: ASTM A951/A951M.

1. Type: Truss.

2. Material: ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M Class 3.

3. Size: 0.1483 inch (3.8 mm) side rods with 0.1483 inch (3.8 mm) cross rods; width as required to provide not less than 5/8 inch (16 mm) of mortar coverage on each exposure.

F. Strap Anchors: Bent steel shapes, 1-1/2 inch (38 mm) width, 0.105 inch (2.7 mm) thick, 24 inch (610 mm) length, with 1-1/2 inch (38 mm) long, 90 degree bend at each end to form a U or Z shape or with cross pins, hot dip galvanized to ASTM A153/A153M Class B.

G. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not less than 5/8 inch (16 mm) of mortar coverage from masonry face.

H. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.

1. Anchor plates: Not less than 0.075 inch (1.91 mm) thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.

2. Wire ties: Manufacturer's standard shape, 0.1875 inch (4.75 mm) thick.

3. Vertical adjustment: Not less than 3-1/2 inches (89 mm).

2.05 FLASHINGS

A. Membrane Asphaltic Flashing Materials:

1. Rubberized Asphalt Flashing: Self-adhering polymer modified asphalt sheet; 40 mils (0.040 inch) (1.0 mm) minimum total thickness; 8 mil (0.20 mm) cross-laminated polyethylene bonded to adhesive rubberized asphalt, with a removable release liner.

a. Manufacturers:

1) Advanced Building Products, Inc; Strip-N-Flash: www.advancedbuildingproducts.com/#sle.

2) Heckmann Building Products, Inc; [____]: www.heckmannbuildingprods.com/#sle

3) [_____].

4) Substitutions: See Section 01 6000 - Product Requirements.

B. Membrane Non-Asphaltic Flashing Materials:

1. Composite Polymer Flashings - Self-Adhering:

a. Composite polyethylene; 40 mil (1mm) thick with pressure-sensitive adhesive and release paper.

b. Thickness: 40 mils (1.0 mm).

c. Tear Resistance: 45 lbs. MD to ASTM D1004;

d. Manufacturers:

e. Tensile Strength (film): 5000 psi ASTM D882

f. Puncture Resistance: 134 lbf to ASTM E154;

g. Low temperature flexibility: -22˚F to CGSB 37-GP-56M;

h. Aluminum termination bar, wire-bond model #4200 required for vertical membrane flashing with a vertical rise greater than 12” or higher, seal top with Henry 925 Sealant.

2. Coordinate with and confirm compatibility with air barrier system.

1) Substitutions: See Section 01 6000 - Product Requirements.

C. EPDM Flashing: ASTM D4637/D4637M, Type I, 0.040 inch (1.0 mm) thick.

1. Manufacturers:

1) Heckmann Building Products, Inc; [____]: www.heckmannbuildingprods.com/#sle

b. Hohmann & Barnard, Inc; [____]: www.h-b.com/#sle.

1) WIRE-BOND; [_____]: www.wirebond.com/#sle.

c. [_____].

d. Substitutions: See Section 01 6000 - Product Requirements.

D. Factory-Fabricated Flashing Corners and Ends: Stainless steel.

1. Manufacturers:

a. Hohmann & Barnard, Inc; [____]: www.h-b.com/#sle.

b. Mortar Net Solutions; [_____]: www.mortarnet.com/#sle.

c. [_____].

d. Substitutions: See Section 01 6000 - Product Requirements.

E. Flashing Sealant/Adhesives: Silicone, polyurethane, or silyl-terminated polyether/polyurethane or other type required or recommended by flashing manufacturer; type capable of adhering to type of flashing used.

1. Manufacturers, Synthetic Rubber Products:

a. Mortar Net Solutions; [_____]: www.mortarnet.com/#sle.

b. [_____].

c. [_____].

d. Substitutions: See Section 01 6000 - Product Requirements.

2.06 ACCESSORIES

A. PVC Control joint Material

1. “Wirebond", extruded polyvinyl chloride, conforming to ASTM D2287, type PVC 654-4; ASTM D2240, Durometer Hardness of 80. Select joint configuration to cover full depth of joint.

2. See Drawings for locations and details.

3. Apply sealant at both sides of joint.

B. Multicomponent Cavity Wall Drainage System: Combination mortar diverter, flashing and weep system.

1. Full course and joint polypropylene plastic weep vent in a range of colors for Architect’s selection and coordination with the range of brick types in the project. Weep vent installed in accordance with 3.13 of this Section. Basis of design “Cell Vent” or approved equal.

C. Cleaning Solution: As recommended by brick manufacturer. Solution shall be non-acidic, to protect adjacent surfaces, such as window frames, door frames and wall cladding from exposure to cleaning

agents.

2.07 MORTAR AND GROUT MIXING

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.

PART 3 EXECUTION

3.01 QUALITY CONTROL

A. Should concrete masonry units be encountered on the job that do not comply with the criteria described in 1.06 and 2.02, then this condition shall be grounds for rejection of the company producing the units as an approved manufacturer.

3.02 INSTALLATION

A. Do not lay masonry when temperature is below 40 degrees F unless suitable means as approved by Architect and Owner's Representative are provided to heat materials. Protect work from cold and frost and insure that mortar will harden without freezing.

B. Build walls and other masonry construction to full thickness indicated, except, build single-wythe walls to actual thickness of masonry units, using units of nominal thickness shown.

C. Build all interior non-bearing masonry walls to full height of story, tight to underside of floor or roof deck. Voids between decking and top of wall shall be filled with fire safing insulation.

D. Build chases and recesses as indicated and as required. Provide not less than 8 inches of masonry between chase or recess and jamb of openings, and between adjacent chases and recesses. Build in chases, do not cut in.

E. Cut masonry units with motor-driven saws designed to cut masonry with clean, sharp, unchipped edges. Cut units as required to provide pattern shown and to fit adjoining work neatly. Use full units without cutting wherever possible.

F. Set units plumb, true to line with level courses accurately spaced within tolerance specified.

G. Lay units in running bond.

H. CMU shall be dry when laid.

I. Adjust unit to final position while mortar is soft and plastic.

J. Cut and fit masonry units, including that required to accommodate work of other sections, by masonry mechanics with masonry saws.

K. Remove units disturbed after mortar has stiffened, clean joints and relay unit with fresh mortar.

L. Grout masonry cells with reinforcing bars solid. Grout lift height and grout pour height shall not exceed 5 feet. Acceptable range for grout slump shall be between 8" and 11". Do not consolidate grout by rodding. Utilize cleanouts at base of masonry walls if necessary to verify that cells have been completely filled.

3.03 JOINING OF WORK

A. Where fresh masonry joins partially or totally set masonry, clean exposed surface of set masonry and remove loose mortar and foreign material prior to laying fresh masonry.

B. If necessary to stop off a horizontal run of masonry, rack back one-half block length in each course. Toothing shall not be permitted.

C. Fill collar joints full.

3.04 PLACING AND BONDING

A. Keep joint free of mortar, debris, or other foreign matter.

B. Refer to drawings for maximum control joint spacing.

C. Wall reinforcement shall be interrupted at control and expansion joints.

D. Provide and install control joints at a maximum of 30 foot spacing and as shown on drawings. If control joints are not indicated on drawings, contractor to provide and install at a maximum of 30 foot spacing. Architect will choose locations for both interior and exterior masonry control joints to be installed by contractor.

E. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.

F. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

3.05 HOLLOW UNIT MORTAR BEDDING

A. Lay with full mortar coverage on horizontal and vertical face shells.

B. Bed webs in courses of piers, columns, and pilasters; in starting course; and where adjacent to cells or cavities to be reinforced or filled with grout.

3.06 SOLID UNIT MORTAR BEDDING

A. Lay with full horizontal and vertical joints.

3.07 WEEPS/CAVITY VENTS

A. Install weeps in veneer and cavity walls at 24 inches (600 mm) on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.

B. Keep weep holes free of mortar and other obstructions.

C. Coordinate location of weep holes with finish grade to avoid covering weep holes by planting soil, sod, or other landscaping materials.

3.08 REINFORCEMENT AND ANCHORAGE - GENERAL, SINGLE WYTHE MASONRY AND CAVITY WALL MASONRY

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches (400 mm) on center.

B. Embed longitudinal wires of joint reinforcement in mortar joint with at least 5/8 inch (16 mm) mortar cover on each side.

C. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 36 inches (900 mm) horizontally and 24 inches (600 mm) vertically.

3.09 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.

B. Provide concealed flashings in masonry work at, or above, all shelf angles, lintels, ledges and other obstructions at the downward flow of water in the wall to divert water to the exterior. Prepare masonry surfaces smooth and free of projections that could puncture flashing. Place through-wall flashing on bed of mortar and cover with mortar. Seal penetrations in flashing with sealant before covering with mortar.

C. Extend flashings full width at such interruptions and at least 6 inches (152 mm), minimum, into adjacent masonry or turn up flashing ends at least [2] inches ([50.8] mm), minimum, to form watertight pan at non-masonry construction. Extend flashing from a line 1/4 inch in from exterior face of outer wythe of masonry, through the outer wythe, turned up a minimum of 4 inches. Terminations which are 12” or

higher shall be secured with a termination bar and sealant.

1. Install in accordance with manufacturer's instructions.
2. Align and position the leading edge of through-wall flashing membrane with the fully adhere membrane over surface.
3. Roll firmly into place. Ensure minimum 2 inch overlap at all end and side laps.
4. Promptly roll all laps and membrane to effect the seal.
5. Ensure all air barrier work is complete prior to applying through-wall flashing.
6. Ensure through-wall flashing membrane extends fully to the exterior face of the exterior masonry veneer. Trim of excess as directed by the Architect.
7. Apply through-wall flashing membrane along the base of masonry veneer walls, over windows, doors and all other wall openings. Flashing shall form continuous flashing and extend up a minimum of 8 inches up the back-up wall.

D. Provide weep holes in the head joints of the same course of masonry bedded in the flashing mortar. Comply with requirements of 3.13 of this Section.

E. Extend plastic, laminated, EPDM and [_____] flashings to within 1/2 inch (12 mm) of exterior face of masonry and adhere to top of stainless steel angled drip with hemmed edge.

3.10 LINTELS

A. Provide precast masonry lintels where indicated and wherever openings of more than 1 foot 0 inch are shown without structural steel or other supporting lintels. Cure precast lintels before handling and installation. Exposed surface finish texture to match lightweight masonry units. Masonry lintels shall bear minimum of 8 in. on each side of opening.

B. Submit data on precast lintels to Architect for review/approval.

3.11 CONTROL AND EXPANSION JOINTS

A. Keep joint free of mortar, debris, or other foreign matter.

B. Refer to drawings for maximum control joint spacing.

C. Wall reinforcement shall be interrupted at control and expansion joints.

D. Provide and install control joints at a maximum of 30 foot spacing and as shown on drawings. If control joints are not indicated on drawings, contractor to provide and install at a maximum of 30 foot spacing. Architect will choose locations for both interior and exterior masonry control joints to be installed by contractor.

E. Do not continue horizontal joint reinforcement through control or expansion joints.

3.12 BUILT-IN WORK

A. Install bolts, anchors, nailing blocks, inserts, doorframes, vents, flashing, conduits, insulation and other built-in items as masonry work progresses.

B. Grout solid with mortar spaces around built-in items.

C. Provide 1/4 inch to 3/8 inch outside joint around exterior doors and other wall openings to receive sealant. Rake and tool smooth to uniform depth of 1/2 inch.

D. Install built-in items plumb, level, and true to line.

E. Do not build into masonry construction organic materials that are subject to deterioration.

3.13 TOLERANCES

A. Maximum Variation from Plumb: 1/4 inch (6 mm) per story non-cumulative; 1/2 inch (13 mm) in two stories or more.

B. Maximum Variation from Level Coursing: 1/8 inch in 3 ft (3 mm/m) and 1/4 inch in 10 ft (6 mm/3 m); 1/2 inch in 30 ft (13 mm/9 m).

C. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch (6 mm).

D. Variation of Linear Building Line: Position indicated in plan and related portion of columns, walls, and partitions, do not exceed 1/2 inch in any bay or 20 feet maximum, nor 3/4 inch in 40 feet or more.

3.14 HORIZONTAL AND VERTICAL FACE JOINTS

A. Uniform 3/8 inch thick unless otherwise required to obtain coursing indicated.

B. Shove vertical joints tight.

C. Tool joints in all exposed masonry surfaces, when thumbprint hard, with round jointer.

D. Cut mortar joints in surfaces covered with finish material flush.

E. Remove mortar protrusions extending into cells or cavities to be reinforced and filled.

F. Fill horizontal joints between top of masonry partitions and underside of concrete slabs or metal deck with compressed mineral wool firesafing insulation (unfaced).

3.15 PARGING

A. Cement Parging: One coat of mortar as specified in Section 04100 with an anti-hydro additive, 1/2" minimum total thickness or as denoted on Drawings.

3.16 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.

3.17 CLEANING

A. Cut out defective joints and holes in exposed masonry and repoint with mortar.

B. Dry brush masonry surface after mortar has set at end of each day's work and after final pointing.

C. Clean exposed masonry with stiff brush and clear water.

D. Apply cleaning agent to sample area of 20 square feet in location acceptable to the Architect if cleaning by water does not produce satisfactory results.

1. Do not proceed with cleaning until sample area is acceptable to Architect.
2. Follow manufacturer's recommendations.
3. Thoroughly wet surface of masonry on which no green efflorescence appears before using cleaning agent.
4. Scrub with acceptable cleaning agent.
5. Immediately rinse with clear water.
6. Work small sections at a time.
7. Work from top to bottom.
8. Protect sash, metal lintels, and other materials that may corrode when masonry is cleaned with acid solution.
9. Remove efflorescence in accordance with brick manufacturer's recommendations.

E. Leave work area and surrounding surfaces clean and free of mortar spots, droppings and broken masonry.

3.18 PROTECTION

A. Provide temporary shoring and bracing for all exterior and interior bearing and exterior bearing walls subsequent to erection and prior to permanent connection to floor or roof systems, or abutting cross walls. Temporarily shore and brace any other walls exposed to lateral forces or other conditions, which would compromise stability prior to completion of building envelope.

B. Protect face materials against staining.

C. Remove misplaced grout or mortar immediately. As walls are constructed, use methods to avoid mortar droppings in cavities.

D. Protect sills, ledges, offsets, and similar items from mortar drippings or other damage during construction.

E. Cover top of walls, so as to prevent any penetration of water, with nonstaining waterproof coverings when work is not in progress.

F. Coverings shall overhang at least 2 feet on each side of wall and be securely anchored.

G. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

3.19 SCHEDULES

A. Exterior Wall: Composite masonry with an exterior wythe of "Dark Brown" brick veneer, bonded with wire ladder reinforcement to inner wythe of interior facing split faced concrete block masonry (CMU) with 2 inch (50 mm) space for insulation.

END OF SECTION

SECTION 04 2500
UNIT MASONRY PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Brick facing.

B. Structural steel stud backing.

C. Reinforcement, anchorages, lifting devices, window frame anchors, and accessories.

D. Grouting under panels.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Anchors cast into building superstructure frame.

B. Section 04 0511 - Mortar and Masonry Grout: Mortar and grout for panels.

C. Section 04 2000 - Unit Masonry: Site constructed masonry elements.

D. Section 04 2001 - Masonry Veneer: Site constructed masonry veneer with masonry backup.

E. Section 04 2300 - Glass Unit Masonry.

F. Section 05 1200 - Structural Steel Framing: Building structural frame.

G. Section 07 2100 - Thermal Insulation: Thermal insulation in stud spaces.

H. Section 07 6200 - Sheet Metal Flashing and Trim: Head and sill flashings.

I. Section 07 9200 - Joint Sealants: Sealing perimeter and intermediate joints.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2018, with Editorial Revision (2018).

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2017.

E. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement 2016.

F. ASTM C67/C67M - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile 2018.

G. ASTM C73 - Standard Specification for Calcium Silicate Brick (Sand-Lime Brick) 2017.

H. ASTM C126 - Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units 2016.

I. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale) 2017a.

J. ASTM C652 - Standard Specification for Hollow Brick (Hollow Masonry Units Made From Clay or Shale) 2017a.

K. ASTM C955 - Standard Specification for Cold-Formed Steel Structural Framing Members 2018.

L. ASTM C1405 - Standard Specification for Glazed Brick (Single Fired, Brick Units) 2016.

M. AWS D1.1/D1.1M - Structural Welding Code - Steel 2015, with Errata (2016).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for face brick and stud framing members. Describe materials and finish, [_____] , product criteria, and limitations.

C. Shop Drawings: Indicate component details, anchorage, loading, welds and lifting hook locations:

1. Indicate method for securing panels to building frame connections and loads imposed.

D. Samples: Submit four samples of face brick units to illustrate color, texture, and extremes of color range.

1.05 QUALITY ASSURANCE

A. Engineering Design: By or under direct supervision of a Professional Structural Engineer experienced in design of work of this type and licensed in Maryland .

B. Fabricator Qualifications: Company specializing in fabricating products of the type specified in this section, with minimum three years of documented experience.

C. Erector Qualifications: Company specializing in installing work of the type specified in this section with three years documented experience, and approved by manufacturer.

D. Mock-Up: Construct panel prototype to actual panel size. Include brick facing in specified bond pattern, steel stud backing, anchors and lifting hooks. Also include prepared window opening.

1. Locate where directed.

2. Mock-up may remain as part of the Work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive panels on site and inspect for damage. Store as directed.

PART 2 PRODUCTS

2.01 PANEL SYSTEM

A. Panel System: Brick and metal frame backup fabricated as a composite panel; with lifting devices for site erection; comply with requirements of ASTM C901.

B. Size and space components to withstand design loads as follows:

C. Design panel system to provide for movement of components without damage, failure of joint seals, and undue stress on fasteners or other detrimental effects, when subject to seasonal and cyclic day/night temperature ranges and when positive and negative wind loads are imposed.

D. Size and locate joints between panels and between panels and adjacent construction as indicated on drawings.

E. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

F. Isolate panels from vertical structural framing members with a control joint as indicated.

G. Isolate top joint of masonry panels from deflecting horizontal structural framing members, slabs, or decks with compressible joint filler.

2.02 BRICK UNITS

A. Facing Brick: ASTM C216, Type FBS, Grade SW.

1. Color and texture to match Architect 's sample.

2. Nominal Size: As indicated on drawings.

3. Special Shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.
4. Compressive Strength: As indicated on drawings, measured in accordance with ASTM C67/C67M.

B. Hollow Facing and Building Brick: ASTM C652, Grade SW; Type HBS; Class H40V.

1. Color and texture to match Architect 's sample.
2. Nominal Size: As indicated on drawings.
3. Compressive Strength: As indicated on drawings, measured in accordance with ASTM C67/C67M.

C. Sand-Lime Brick: ASTM C73, Grade SW.

1. Actual Size: As indicated on drawings.

D. Glazed Brick (Single Fired, Brick Units): ASTM C1405, Grade S (standard), Type I (single-faced units), Class Exterior, Division Solid.

1. Color and texture to match Architect 's sample.
2. Nominal size: As indicated on drawings.
3. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn without chipping glaze to produce equivalent effect.

E. Glazed Brick (Double Fired, Brick Units):

1. Glazed Facing Brick: ASTM C216, Type FBS Smooth, Grade SW with ceramic glaze complying with ASTM C126.
2. Glazed Hollow Facing Brick: ASTM C652, Grade SW; Type HBS; Class H40V with ceramic glaze complying with ASTM C126.
3. Nominal size: As indicated on drawings.
4. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn without chipping glaze to produce equivalent effect.

F. Ceramic Glazed Face Brick: ASTM C126, Grade S (Select), Type I (single-faced units).

1. Color and texture to match Architect 's sample.
2. Actual Size: As indicated on drawings.
3. Special Shapes: Molded units as required by conditions indicated, unless standard units can be sawn without chipping glaze to produce equivalent effect.
4. Compressive Strength: As indicated on drawings, measured in accordance with ASTM C67/C67M.

2.03 BACKING MATERIALS

A. Structural Framing Members and Anchors: ASTM A 36/A 36M steel, uncoated finish.

B. Studs and Track: ASTM C955; studs formed to channel shape with punched web; U-shaped track in matching nominal width and compatible height.

1. Gage and Depth: As required to meet specified performance levels.
2. Galvanized in accordance with ASTM A653/A653M G90/Z275 coating.

C. Plates, Gussets, Clips: Formed sheet steel, thickness determined for conditions encountered, same finish as framing members.

D. Self-Drilling, Self-Tapping Screws: Hardened and hot dip galvanized to ASTM A153/A153M, Class D.

E. Anchorage Devices: Drilled expansion bolts.

2.04 ACCESSORIES

A. Panel Joint Filler: Closed cell polyurethane; oversized 50 percent to joint width; self-expanding [____] inch ([____] mm) wide by maximum lengths.

B. Weep/Cavity Vents: Preformed aluminum vents with sloping louvers.

C. Brick Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.

D. Brick Joint Reinforcement: ASTM A951/A951M.

1. Type: Truss.

2. Material: ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M Class 3.

E. Brick Reinforcement: ASTM A615/A615M, Grade 40 (40,000 psi) (280 MPa) deformed billet steel bars, uncoated.

F. Two-Piece Wall Ties: Formed steel wire, 0.1875 inch (4.8 mm) thick, adjustable, eye and pintle type, hot dip galvanized to ASTM A 153/A 153M, Class B, sized to provide not less than 5/8 inch (16 mm) of mortar coverage from masonry face and to allow vertical adjustment of up to 1-1/4 in (32 mm).

G. Panel Spacers: Lead.

H. Touch-up Primer: Zinc rich oil alkyd.

I. Lifting Devices: ASTM A36/A36M weldable steel.

2.05 MORTAR AND GROUT

A. Mortar and Grout: Specified in Section 04 0511.

2.06 FABRICATION - PANEL BACKING

A. Fabricate panel frame in prepared jig.

B. Align top and bottom tracks and panel edge frame; secure with fasteners and weld.

C. Attach and secure corner gussets to ensure panel alignment and dimensional integrity.

D. Place studs, brace, and reinforce to develop full strength to meet design requirements.

E. Install framing between studs for attachment of mechanical and electrical items and to prevent stud rotation or distortion.

F. Perform welding in accordance with AWS D1.1/D1.1M.

2.07 FABRICATION - FACE BRICK PANELS

A. Establish lines, levels, and coursing to panel.

B. Maintain masonry courses to uniform spacing. Form joints to achieve uniform dimension.

C. Install weep/cavity vents in veneer at 24 inches (600 mm) on center horizontally at bottom course of panel.

D. Place bar reinforcement in brick cores; fill with grout.

2.08 BUILT IN WORK

A. Install built-in glazed frames, fabricated [_____] frames, window frames, anchor bolts, plates, other items furnished by other sections and [_____].

B. Install built-in items plumb and level.

2.09 PANEL REINFORCEMENT AND ANCHORAGES

A. Secure backing panel to brick panel and reinforce.

2.10 FABRICATION TOLERANCES

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated on shop drawings.

B. Verify that supporting structure is ready to receive prefabricated panels.

C. Verify items provided in other sections of work are appropriately sized and located.

D. Verify that utility rough-ins are properly located and ready for panel placement.

3.02 ERECTING PANELS

A. Erect panels without damage to shape or finish. Replace damaged panels.

B. Erect members level and plumb within allowable tolerances.

C. Align and maintain uniform horizontal and vertical panel joints as erection progresses.

D. When panels require adjustment beyond design or tolerance criteria, discontinue affected work; advise Architect .

E. Fasten and weld units in place.

1. Perform welding, including tack welding, in accordance with AWS D1.1/D1.1M.

F. Touch up field welds and scratched or damaged surfaces.

3.03 CUTTING AND FITTING

A. Obtain approval prior to cutting or fitting panels not indicated or where appearance or strength of panels may be impaired.

3.04 CLEANING

A. Remove excess mortar and grout.

B. Clean soiled surfaces with non-acidic solution that will not harm masonry or adjacent materials. Consult masonry manufacturer for acceptable cleaners.

C. Use non-metallic tools in cleaning operations.

3.05 PROTECTION

A. Maintain protective boards at exposed external corners of panels that may be damaged by construction activities.

B. Provide protection without damaging completed work.

END OF SECTION

SECTION 04 2600
SINGLE-WYTHE UNIT MASONRY

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PART 1 GENERAL

2.01 SECTION INCLUDES

A. Concrete masonry units.

B. Pre-faced unit masonry.

C. Reinforcement, anchorage, and accessories.

D. Flashings.

E. Parged masonry surfaces.

2.02 RELATED REQUIREMENTS

A. Section 03 2000 - Concrete Reinforcing: Reinforcing steel for grouted masonry.

B. Section 04 0511 - Mortar and Masonry Grout: Mortar and grout for single wythe unit masonry.

C. Section 06 1000 - Rough Carpentry: Nailing strips for installation in masonry.

D. Section 07 6200 - Sheet Metal Flashing and Trim: Cap flashings over masonry work.

E. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.

2.03 REFERENCE STANDARDS

A. ASTM C34 - Standard Specification for Structural Clay Load-Bearing Wall Tile 2017.

B. ASTM C55 - Standard Specification for Concrete Building Brick 2017.

C. ASTM C56 - Standard Specification for Structural Clay Nonloadbearing Tile 2013.

D. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units 2016a.

E. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units 2017.

F. ASTM C212 - Standard Specification for Structural Clay Facing Tile 2017.

G. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale) 2017a.

H. ASTM C530 - Standard Specification for Structural Clay Nonloadbearing Screen Tile 2013.

I. ASTM C652 - Standard Specification for Hollow Brick (Hollow Masonry Units Made From Clay or Shale) 2017a.

J. ASTM C744 - Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units 2016.

K. ASTM C1634 - Standard Specification for Concrete Facing Brick 2017.

L. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing 2017.

M. ASTM D4637/D4637M - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane 2015.

N. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing 2017.

O. BIA Techical Notes No. 28B - Brick Veneer/Steel Stud Walls 2005.

P. BIA Technical Notes No. 46 - Maintenance of Brick Masonry 2017.

Q. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures 2016.

R. UL (FRD) - Fire Resistance Directory Current Edition.

2.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for decorative and pre-faced masonry units and fabricated wire reinforcement.

C. Samples: Submit four samples of decorative block and pre-faced units to illustrate color, texture and extremes of color range.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Maintenance Materials: Furnish the following for Owner 's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Glazed Units: 50 of each type, size, and color combination.
3. Extra Pre-Faced Units: 50 of each type, size, and color combination.

2.05 QUALITY ASSURANCE

A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of the contract documents.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

2.06 MOCK-UP

A. Construct a masonry wall as a mock-up panel sized 8 feet (2.4 m) long by 6 feet (1.8 m) high; include mortar and accessories in mock-up.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

2.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

B. Handle and store ceramic glazed masonry units in protective cartons or trays. Do not remove from protective packaging until ready for installation.

2.08 FIELD CONDITIONS

A. Cold and Hot Weather Requirements: Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

3.01 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:

1. Regulatory Requirements: Comply with applicable code for UL Assembly No. [____].
2. Size: Standard units with nominal face dimensions of 16 x 8 inches (400 x 200 mm) and nominal depth of 4 inches (100 mm).

3. Special Shapes: Provide non-standard blocks configured for corners.
4. Load-Bearing Units: ASTM C90, normal weight.
    a. Hollow block, as indicated.
    b. Exposed Faces: Manufacturer's standard color and texture where indicated.
    c. Pattern: [_____].
5. Non-Loadbearing Units: ASTM C129.
    a. Hollow block, as indicated.
    b. Lightweight.
6. Pre-Faced Units: ASTM C90, hollow block, with smooth resinous facing complying with ASTM C744.
    a. Colors and Styles: As indicated on drawings.
    b. Manufacturer: [_____].
    c. Substitutions: See Section 01 6000 - Product Requirements.

B. Concrete Brick:
1. Size: As indicated on drawings.
2. Concrete Building Brick: ASTM C55; lightweight, solid, for interior or concealed use.
3. Concrete Facing Brick: ASTM C1634; solid, lightweight; for architectural, paver and below grade use.
    a. Exposed Faces: Color and texture to be selected from manufacturer's standard range.
    b. Manufacturers:
        1) [_____].
        2) [_____].
        3) [_____].
        4) Substitutions: See Section 01 6000 - Product Requirements.

3.02 GIANT BRICK UNITS

A. Manufacturers:
1. Endicott Clay Products Co; [_____]: www.endicott.com/#sle.
2. General Shale Brick; [_____]: www.generalshale.com/#sle.
3. Meridian Brick LLC; [_____]: www.meridianbrick.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Giant Facing Brick: ASTM C216, Type FBS, Grade SW.
1. Color and texture to match Architect 's sample.
2. Nominal size: As indicated on drawings.

C. Hollow Facing and Building Brick: ASTM C652, Grade SW; Type HBS; Class H40V.
1. Color and texture to match Architect 's sample.
2. Actual size: As indicated on drawings.

3.03 CLAY TILE UNITS

A. Manufacturers:

1. [_____]; [_____].

B. Structural Clay Load-Bearing Wall Tile: ASTM C34, Grade LBX; end-construction type; plaster-base finish.

C. Structural Clay Non-Load-Bearing Tile: ASTM C56, Grade NB; plaster-base finish.

D. Structural Clay Non-Load-Bearing Screen Tile: ASTM C530, Grade SE; Type STX; smooth finish.

E. Structural Clay Facing Tile: ASTM C212, Type FTX; Standard Class; single-face units; end-construction type.

1. Actual size: As indicated on drawings.

3.04 MORTAR AND GROUT MATERIALS

A. Mortar and Grout: As specified in Section 04 0511.

3.05 REINFORCEMENT AND ANCHORAGE

A. Manufacturers:

1. Blok-Lok Limited; [_____]: www.blok-lok.com/#sle.
2. Hohmann & Barnard, Inc; [_____]: www.h-b.com/#sle.
3. [_____].

B. Reinforcing Steel: Type specified in Section 03 2000; size as indicated on drawings; galvanized finish.

C. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.

D. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm) of mortar coverage from masonry face.

3.06 FLASHINGS

A. Metal Flashing Materials:

1. Prefabricated Metal Flashing: Smooth fabricated 12 oz/sq ft (3.66 kg/sq m) copper flashing for surface mounted conditions.
    a. Manufacturers:
        1) Cheney Flashing Company; [____]: www.cheneyflashing.com/#sle.
        2) Hohmann & Barnard, Inc; [____]: www.h-b.com/#sle.

B. Membrane Asphaltic Flashing Materials:

1. Rubberized Asphalt Flashing: Self-adhering polymer modified asphalt sheet; 40 mils (0.040 inch) (1.0 mm) minimum total thickness; 8 mil (0.20 mm) cross-laminated polyethylene bonded to adhesive rubberized asphalt, with a removable release liner.
    a. Manufacturers:
        1) Advanced Building Products, Inc; [_____]: www.advancedbuildingproducts.com/#sle.
        2) Heckmann Building Products, Inc; [____]: www.heckmannbuildingprods.com/#sle
        3) WIRE-BOND; [_____]: www.wirebond.com/#sle.
        4) Substitutions: See Section 01 6000 - Product Requirements.

C. Membrane Non-Asphaltic Flashing Materials:

1. Composite Polymer Flashings - Self-Adhering: Composite polyethylene; 40 mil (1mm) thick with pressure-sensitive adhesive and release paper.

a. Manufacturers:

1) Hyload, Inc; [____]: www.hyload.com/#sle.

2) Substitutions: See Section 01 6000 - Product Requirements.

D. EPDM Flashing: ASTM D4637/D4637M, Type I, 0.040 inch (1.0 mm) thick.

1. Manufacturers:

a. Hohmann & Barnard, Inc; [____]: www.h-b.com/#sle.

1) WIRE-BOND; [_____]: www.wirebond.com/#sle.

b. [_____].

c. [_____].

d. Substitutions: See Section 01 6000 - Product Requirements.

E. Flashing Sealant/Adhesives: Silicone, polyurethane, or silyl-terminated polyether/polyurethane, or other type required or recommended by flashing manufacturer; type capable of adhering to type of flashing used.

F. Termination Bars: Stainless steel; compatible with membrane and adhesives.

G. Drip Edge: Stainless steel; angled drip with hemmed edge; compatible with membrane and adhesives.

H. Lap Sealants and Tapes: As recommended by flashing manufacturer; compatible with membrane and adhesives.

3.07 ACCESSORIES

A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.

1. Manufacturers:

a. Substitutions: See Section 01 6000 - Product Requirements.

B. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; [____] inch ([____] mm) wide x by maximum lengths available.

C. Flashing - Weep - Vent System: Polypropylene pan and bridge unit with polyester mesh drainage mats and bug guards; wall system size: 12 inch (304.8 mm).

D. Building Paper: ASTM D226/D226M, Type I ("No. 15") asphalt felt.

E. Nailing Strips: Preservative treated softwood, as specified in Section 06 1000.

F. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

3.08 LINTELS

A. Precast Concrete Lintels: [_____] type, [____x____] inch ([____x____] mm) size, [____] psi ([____] MPa) strength at 28 days.

1. Manufacturers:

a. [_____].

b. [_____].

c. [_____].

d. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

4.01 INSTALLERS

A. Installer List:

1. [_____].
2. [_____].
3. [_____].
4. Substitution Limitations: Same as specified for products; see Section 01 6000 - Product Requirements.

4.02 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

4.03 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

4.04 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:

D. Giant Brick Units:

E. Clay Tile Units:

4.05 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Remove excess mortar as work progresses.

D. Interlock intersections and external corners, except for units laid in stack bond.

E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

4.06 REINFORCEMENT AND ANCHORAGE

A. Install horizontal joint reinforcement 16 inches (400 mm) on center.

B. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Space anchors at maximum of 24 inches (600 mm) horizontally and 16 inches (400 mm) vertically.

4.07 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.

1. Extend flashings full width at such interruptions and at least 6 inches (152 mm), minimum, into adjacent masonry or turn up at least 1 inch (25.4 mm), minimum, to form watertight pan at non-masonry construction.

2. Remove or cover protrusions or sharp edges that could puncture flashings.
3. Seal lapped ends and penetrations of flashing before covering with mortar.

B. Lap end joints of flashings at least 6 inches (152 mm), minimum, and seal watertight with flashing sealant/adhesive.

4.08 LINTELS

A. Install loose steel lintels over openings.

B. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.

C. Maintain minimum [____] inch ([____] mm) bearing on each side of opening.

4.09 GROUTED COMPONENTS

A. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch (13 mm) of dimensioned position.

B. Place and consolidate grout fill without displacing reinforcing.

C. At bearing locations, fill masonry cores with grout for a minimum 12 inches (300 mm) either side of opening.

4.10 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.

B. Size control joints as indicated on drawings; if not shown, 3/4 inch (19 mm) wide and deep.

4.11 BUILT-IN WORK

A. As work progresses, install built-in metal door frames and other items to be built into the work and furnished under other sections.

B. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.

C. Do not build into masonry construction organic materials that are subject to deterioration.

4.12 TOLERANCES

A. Install masonry within the site tolerances found in TMS 402/602.

4.13 CUTTING AND FITTING

A. Cut and fit for chases. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

4.14 PARGING

A. Dampen masonry walls prior to parging.

B. Scarify each parging coat to ensure full bond to subsequent coat.

C. Strike top edge of parging at 45 degrees.

4.15 FIELD QUALITY CONTROL

A. An independent testing agency, as specified in Section 01 4000 - Quality Requirements, will conduct field tests.

4.16 CLEANING

A. Remove excess mortar and mortar smears as work progresses.

B. Clean soiled surfaces with cleaning solution.

C. Use non-metallic tools in cleaning operations.

4.17 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

4.18 SCHEDULES

A. Exterior Wall: Single wythe of split faced decorative block unit masonry.

B. Interior Block Partitions: Clay tile units prepared for wet plaster finish.

C. Interior Fire Walls: One hour rating, grout filled concrete block units.

END OF SECTION

SECTION 04 2723
CAVITY WALL UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete block.

B. Concrete building brick.

C. Concrete facing brick.

D. Clay facing brick.

E. Common brick

F. Hollow brick.

G. Sand-lime face brick.

H. Ceramic glazed face brick.

I. Clay tile.

J. Reinforcement and anchorage.

K. Flashings.

L. Lintels.

M. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 2000 - Concrete Reinforcing: Reinforcing steel for grouted masonry.

B. Section 04 0100 - Maintenance of Masonry.

C. Section 04 0511 - Mortar and Masonry Grout.

D. Section 04 4313 - Stone Masonry Veneer: Rough stone bonded to masonry back-up.

E. Section 06 1000 - Rough Carpentry: Nailing strips built into masonry.

F. Section 07 2100 - Thermal Insulation: Insulation for cavity spaces.

G. Section 07 2123 - Loose-Fill Insulation: Granular insulation for masonry wall cavity.

H. Section 07 6200 - Sheet Metal Flashing and Trim: Through-wall masonry flashings.

I. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.

1.03 PRICE AND PAYMENT PROCEDURES

A. See Section 01 2100 - Allowances, for cash allowances affecting this section.

B. This allowance includes purchase and delivery of [_____]. Installation is not included in the allowance but is specified in this section and is part of the Contract Sum/Price.

1.04 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

B. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire 2009a (Reapproved 2014).

C. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement 2016.

D. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2018.

E. ASTM C34 - Standard Specification for Structural Clay Load-Bearing Wall Tile 2017.

F. ASTM C55 - Standard Specification for Concrete Building Brick 2017.

G. ASTM C56 - Standard Specification for Structural Clay Nonloadbearing Tile 2013.

H. ASTM C67/C67M - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile 2018.

I. ASTM C73 - Standard Specification for Calcium Silicate Brick (Sand-Lime Brick) 2017.

J. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units 2016a.

K. ASTM C126 - Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units 2016.

L. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units 2017.

M. ASTM C140/C140M - Standard Test Methods of Sampling and Testing Concrete Masonry Units and Related Units 2017a.

N. ASTM C212 - Standard Specification for Structural Clay Facing Tile 2017.

O. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale) 2017a.

P. ASTM C652 - Standard Specification for Hollow Brick (Hollow Masonry Units Made From Clay or Shale) 2017a.

Q. ASTM C744 - Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units 2016.

R. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry 2018a.

S. ASTM C1405 - Standard Specification for Glazed Brick (Single Fired, Brick Units) 2016.

T. ASTM C1634 - Standard Specification for Concrete Facing Brick 2017.

U. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing 2017.

V. UL (FRD) - Fire Resistance Directory Current Edition.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement and mortar.

C. Samples: Submit four samples of decorative block units to illustrate color, texture, and extremes of color range.

D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

E. Maintenance Materials: Furnish the following for Owner 's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of the contract documents.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.07 MOCK-UP

A. Construct a masonry cavity wall as a mock-up panel sized 8 feet (2.4 m) long by 6 feet (1.8 m) high; include mortar and accessories, reinforcement, flashings and wall insulation in mock-up.

B. Mock-up may remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

1.09 FIELD CONDITIONS

A. Maintain materials and surrounding air temperature to minimum 40 degrees F (5 degrees C) prior to, during, and 48 hours after completion of masonry work.

B. Maintain materials and surrounding air temperature to maximum 90 degrees F (32 degrees C) prior to, during, and 48 hours after completion of masonry work.

PART 2 PRODUCTS

2.01 UNIT MASONRY - GENERAL

A. Comply with applicable code for UL (FRD) Assembly No. [____].

2.02 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:

1. Size: Standard units with nominal face dimensions of 16 by 8 inches (400 by 200 mm) and nominal depth of 8 inches (200 mm).
2. Special Shapes: Provide non-standard blocks configured for corners.
3. Load-Bearing Units: ASTM C90, normal weight.
    a. Exposed faces: Manufacturer's standard color and texture where indicated.
    b. Pattern: Vertical single score.
4. Non-Loadbearing Units: ASTM C129.
5. Pre-Faced Units: ASTM C90, hollow block, with smooth resinous facing complying with ASTM C744.

B. Concrete Brick:

1. Size: As indicated on drawings.
2. Concrete Building Brick: ASTM C55; lightweight, solid, for interior or concealed use.
3. Concrete Facing Brick: ASTM C1634; solid, lightweight; for architectural, paver and below grade use.
    a. Exposed Faces: Color and texture to be selected from manufacturer's standard range.
    b. Manufacturers:
        1) [_____].
        2) [_____].
        3) [_____].

4) Substitutions: See Section 01 6000 - Product Requirements.

2.03 BRICK UNITS

A. Manufacturers:

1. Endicott Clay Products Co; [_____]: www.endicott.com/#sle.
2. General Shale Brick; [_____]: www.generalshale.com/#sle.
3. Meridian Brick LLC; [_____]: www.meridianbrick.com/#sle.
4. [_____].

B. Facing Brick: ASTM C216, Type FBS, Grade SW.

1. Nominal Size: As indicated on drawings.
2. Special Shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.
3. Compressive Strength: As indicated on drawings, measured in accordance with ASTM C67/C67M.

C. Building (Common) Brick: ASTM C62, Grade SW; solid units.

1. Nominal Size: As indicated on drawings.
2. Compressive Strength: As indicated on drawings, measured in accordance with ASTM C67/C67M.

D. Hollow Facing and Building Brick: ASTM C652, Grade SW; Type HBS; Class H40V.

1. Actual Size: As indicated on drawings.
2. Compressive Strength: As indicated on drawings, measured in accordance with ASTM C67/C67M.

E. Sand-Lime Brick: ASTM C73, Grade SW.

1. Color and texture to match Architect 's sample.
2. Actual Size: As indicated on drawings.

F. Glazed Brick (Single Fired, Brick Units): ASTM C1405, Grade S (standard), Type I (single-faced units), Class Exterior, Division Solid.

1. Nominal size: As indicated on drawings.
2. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn without chipping glaze to produce equivalent effect.

G. Glazed Brick (Double Fired, Brick Units):

1. Glazed Facing Brick: ASTM C216, Type FBS Smooth, Grade SW with ceramic glaze complying with ASTM C126.
2. Nominal size: As indicated on drawings.
3. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn without chipping glaze to produce equivalent effect.

H. Ceramic Glazed Face Brick: ASTM C126, Grade S (Select), Type I (single-faced units).

1. Actual Size: As indicated on drawings.
2. Special Shapes: Molded units as required by conditions indicated, unless standard units can be sawn without chipping glaze to produce equivalent effect.
3. Compressive Strength: As indicated on drawings, measured in accordance with ASTM C67/C67M.

2.04 CLAY TILE UNITS

A. Manufacturers:

1. Elgin Butler Company; [____]: www.elginbutler.com/#sle.
2. Sandkuhl Clay Works; [_____]: www.sandkuhl.com/#sle.
3. [_____].
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Structural Clay Load-Bearing Wall Tile: ASTM C34, Grade LBX; end-construction type; plaster-base finish.

1. Actual Size: As indicated on drawings.

C. Structural Clay Non-Load-Bearing Tile: ASTM C56, Grade NB; plaster-base finish.

1. Actual Size: As indicated on drawings.

D. Structural Clay Facing Tile: ASTM C212, Type FTX; Standard Class; single-face units; end-construction type.

1. Actual Size: As indicated on drawings.
2. Special Shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.

2.05 MORTAR AND GROUT MATERIALS

A. Mortar and Grout: As specified in Section 04 0511.

2.06 REINFORCEMENT AND ANCHORAGE

A. Manufacturers:

1. Blok-Lok Limited; [_____]: www.blok-lok.com/#sle.
2. Hohmann & Barnard, Inc; [_____]: www.h-b.com/#sle.
3. WIRE-BOND: www.wirebond.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Reinforcing Steel: Type specified in Section 03 2000; size as indicated on drawings; galvanized finish.

C. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.

D. Multiple Wythe Joint Reinforcement: ASTM A951/A951M.

1. Type: Truss.
2. Material: ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M Class 3.
3. Size: 0.1483 inch (3.8 mm) side rods with 0.1483 inch (3.8 mm) cross rods; width as required to provide not less than 5/8 inch (16 mm) of mortar coverage on each exposure.

E. Adjustable Multiple Wythe Joint Reinforcement: ASTM A951/A951M.

1. Size: 0.1875 inch (4.8 mm) side rods with 0.1483 inch (3.8 mm) cross rods and adjustable components of 0.1875 inch (4.8 mm)wire, width of components as required to provide not less than 5/8 inch (16 mm) of mortar coverage from each masonry face.

F. Strap Anchors: Bent steel shapes configured as required for specific situations, 1-1/4 in (32 mm) width, 0.105 in (2.7 mm) thick, lengths as required to provide not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm) of mortar coverage from masonry face, corrugated for embedment in masonry joint, hot dip galvanized to ASTM A 153/A 153M, Class B.

G. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm) of mortar coverage from masonry face.

2.07 FLASHINGS

A. Metal Flashing Materials: Copper, as specified in Section 07 6200.

B. Membrane Asphaltic Flashing Materials:

1. Rubberized Asphalt Flashing: Self-adhering polymer modified asphalt sheet; 40 mils (0.040 inch) (1.0 mm) minimum total thickness; 8 mil (0.20 mm) cross-laminated polyethylene bonded to adhesive rubberized asphalt, with a removable release liner.

a. Manufacturers:

1) Advanced Building Products, Inc; Strip-N-Flash: www.advancedbuildingproducts.com/#sle.

2) Heckmann Building Products, Inc; [____]: www.heckmannbuildingprods.com/#sle

C. Membrane Non-Asphaltic Flashing Materials:

1. Composite Polymer Flashings - Self-Adhering: Composite polyethylene; 40 mil (1mm) thick with pressure-sensitive adhesive and release paper.

a. Manufacturers:

1) Hohmann & Barnard, Inc; [____]: www.h-b.com/#sle.

2) Hyload, Inc; [____]: www.hyload.com/#sle.

3) [_____].

D. EPDM Flashing: ASTM D4637/D4637M, Type I, 0.040 inch (1.0 mm) thick.

1. Manufacturers:

1) Heckmann Building Products, Inc; [____]: www.heckmannbuildingprods.com/#sle

b. Hohmann & Barnard, Inc; [____]: www.h-b.com/#sle.

c. [_____].

d. Substitutions: See Section 01 6000 - Product Requirements.

E. Factory-Fabricated Flashing Corners and Ends: Stainless steel.

1. Manufacturers:

a. Hohmann & Barnard, Inc; [____]: www.h-b.com/#sle.

b. Mortar Net Solutions; [_____]: www.mortarnet.com/#sle.

c. [_____].

F. Flashing Sealant/Adhesives: Silicone, polyurethane, or silyl-terminated polyether/polyurethane, or other type required or recommended by flashing manufacturer; type capable of adhering to type of flashing used.

1. Manufacturers, Synthetic Rubber Products:

a. Mortar Net Solutions; [_____]: www.mortarnet.com/#sle.

b. [_____].

c. [_____].

d. Substitutions: See Section 01 6000 - Product Requirements.

2.08 ACCESSORIES

A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.

1. Manufacturers:

a. Blok-Lok Limited; [_____]: www.blok-lok.com/#sle.

b. Hohmann & Barnard, Inc; [_____]: www.h-b.com/#sle.

c. WIRE-BOND; [_____]: www.wirebond.com/#sle.

d. Substitutions: See Section 01 6000 - Product Requirements.

B. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; in maximum lengths available.

1. Manufacturers:

a. Hohmann & Barnard, Inc; [_____]: www.h-b.com/#sle.

b. WIRE-BOND; [_____]: www.wirebond.com/#sle.

c. [_____].

d. Substitutions: See Section 01 6000 - Product Requirements.

C. Nailing Strips: Softwood lumber, preservative treated; as specified in Section 06 1000.

D. Weeps:

1. Type: Polyester mesh.

2. Color(s): As indicated on drawings.

3. Manufacturers:

a. Advanced Building Products, Inc; [_____]: www.advancedbuildingproducts.com/#sle.

b. Blok-Lok Limited; [_____]: www.blok-lok.com/#sle.

c. CavClear/Archovations, Inc; [_____]: www.cavclear.com/#sle.

d. [_____].

e. Substitutions: See Section 01 6000 - Product Requirements.

E. Cavity Vents:

1. Type: Preformed aluminum vents with sloping louvers.

2. Color(s): As indicated on drawings.

3. Manufacturers:

a. Advanced Building Products, Inc; [_____]: www.advancedbuildingproducts.com/#sle.

b. Blok-Lok Limited; [_____]: www.blok-lok.com/#sle.

c. Substitutions: See Section 01 6000 - Product Requirements.

F. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

A. Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.

3.04 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:

D. Brick Units:

E. Clay Tile Units:

3.05 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

3.06 WEEPS/CAVITY VENTS

A. Install weeps in cavity walls at 24 inches (600 mm) on center horizontally above through-wall flashing, above shelf angles and lintels and at bottom of walls.

B. Install cavity vents in cavity walls at 32 inches (800 mm) on center horizontally below shelf angles and lintels and at top of walls.

3.07 CAVITY WALL CONSTRUCTION

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

B. Install cavity mortar diverter at base of cavity as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

C. Install cavity mortar control panels continuously throughout full height of exterior masonry cavities during construction of exterior wythe, complying with manufacturer's installation instructions.

D. Build inner wythe ahead of outer wythe to receive accessories.

3.08 REINFORCEMENT AND ANCHORAGES - CAVITY WALL MASONRY

A. Place continuous joint reinforcement in first and second joint below top of walls.

B. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Space anchors at maximum of 24 inches (600 mm) horizontally and 16 inches (400 mm) vertically.

3.09 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.

B. Install flashing in accordance with manufacturer's instructions and BIA Technical Notes No. 7.

C. Extend metal flashings through exterior face of masonry and terminate in an angled drip with hemmed edge. Install joint sealer below drip edge to prevent moisture migration under flashing.

3.10 LINTELS

A. Install loose steel lintels over openings.

B. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.

3.11 CONTROL AND EXPANSION JOINTS

A. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

3.12 CUTTING AND FITTING

A. Cut and fit for chases. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.13 PARGING

A. Dampen masonry walls prior to parging.

B. Scarify each parging coat to ensure full bond to subsequent coat.

3.14 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000.

B. Clay Masonry Unit Tests: Test each variety of clay masonry in accordance with ASTM C67/C67M requirements, sampling 5 randomly chosen units for each 50,000 installed.

C. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C140/C140M for compliance with requirements of this specification.

D. Mortar Tests: Test each type of mortar in accordance with recommended procedures in ASTM C780, testing with same frequency as masonry samples.

3.15 CLEANING

A. Remove excess mortar and mortar smears as work progresses.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.16 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 04 4200
EXTERIOR STONE CLADDING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cut limestone, marble, travertine, granite, slate and sandstone veneer at exterior and interior walls.

B. Metal anchors and supports.

C. Sealing exterior joints.

D. Pointing interior joints.

1.02 RELATED REQUIREMENTS

A. Section 04 4313 - Stone Masonry Veneer: Thick stone set in mortar.

B. Section 05 1200 - Structural Steel Framing: Steel framing members supporting stone.

C. Section 05 4000 - Cold-Formed Metal Framing: Steel framing members supporting stone.

D. Section 05 5000 - Metal Fabrications: Steel framing members supporting stone.

E. Section 05 5000 - Metal Fabrications: Shelf angles and supports.

F. Section 05 5000 - Metal Fabrications: Metal fabricated items for building into cut stone.

G. Section 07 6200 - Sheet Metal Flashing and Trim: Flashings at copings, lintels and sills.

H. Section 07 9200 - Joint Sealants: Sealing perimeter and expansion joints in interior stone work.

1.03 REFERENCE STANDARDS

A. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications 2016.

B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

C. ASTM C270 - Standard Specification for Mortar for Unit Masonry 2014a.

D. ASTM C503/C503M - Standard Specification for Marble Dimension Stone 2015.

E. ASTM C568/C568M - Standard Specification for Limestone Dimension Stone 2015.

F. ASTM C615/C615M - Standard Specification for Granite Dimension Stone 2018e1.

G. ASTM C616/C616M - Standard Specification for Quartz-Based Dimension Stone 2015.

H. ASTM C629/C629M - Standard Specification for Slate Dimension Stone 2015.

I. ILI (HB) - Indiana Limestone Handbook 2007.

J. MIA (DSDM) - Dimensional Stone Design Manual, Version VIII 2016.

K. NBGQA (SPEC) - Specifications for Architectural Granite, Version 18-1 2018.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on stone, mortar products, and sealant products.

C. Shop Drawings: Indicate layout, pertinent dimensions, anchorages, head, jamb, and sill opening details, and jointing methods.

D. Samples: Submit two stone samples [__ by __] inch ([__ by __] mm) in size, illustrating color range and texture, markings, surface finish, and [_____].

E. Samples: Submit mortar color samples.

F. Installation Instructions: Submit stone fabricator's installation instructions and field erection or setting drawings; indicate panel identifying marks and locations on setting drawings.

1.05 QUALITY ASSURANCE

A. Design anchors and supports under direct supervision of a Professional Structural Engineer, registered in Maryland .

1. Design anchors to resist positive and negative wind pressures and other loads as required by applicable code.

2. Design anchor attachment to stone with a factor of safety of 5:1.

3. Design each individual anchor with a factor of safety in the vertical dead-load-bearing direction of 4:1 and in the horizontal lateral-load-bearing direction of 2:1.

B. Perform work in accordance with ILI Indiana Limestone Handbook.

C. Perform work in accordance with NBGQA (SPEC).

D. Perform work in accordance with MIA Dimensional Stone Design Manual.

1.06 MOCK-UP

A. Construct stone wall mock-up, [____] feet ([____] m) long by [____] feet ([____] m) wide, including stone anchor accessories, sill and head flashings , window frame , corner condition , typical control joint , and [_____].

B. Locate where directed.

C. Mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store stone panels vertically on edge, resting weight on panel edge.

B. Protect stone from discoloration.

1.08 FIELD CONDITIONS

A. During temporary storage on site, at the end of working day, and during rainy weather, cover stone work exposed to weather with non-staining waterproof coverings, securely anchored.

PART 2 PRODUCTS

2.01 STONE

A. Limestone: Indiana Oolitic Limestone; complying with ASTM C568/C568M Classification II - Medium Density.

B. Marble: [_____] type; complying with ASTM C503/C503M Classification I - Calcite.

C. Travertine: [_____] type; complying with ASTM C503/C503M Classification IV - Travertine.

D. Granite: [_____]; complying with ASTM C615/C615M.

E. Slate: [_____]; complying with ASTM C629/C629M Classification I - Exterior.

F. Sandstone: [_____]; complying with ASTM C616/C616M Classification I - Sandstone.

2.02 MORTAR

A. Mortar: ASTM C270, Type N, Proportion specification, using Portland cement of white color.

2.03 ANCHORS AND ACCESSORIES

A. Anchors and Other Components in Contact with Stone: Stainless steel, ASTM A666 Type 304.

1. Sizes and configurations: As required for vertical and horizontal support of stone and applicable loads.
2. Wire ties are not permitted.

B. Support Components not in Contact with Stone: Stainless steel, ASTM A240/A240M Type 304.

C. Setting Buttons and Shims: Lead type.

D. Joint Sealant: ASTM C920 silicone sealant with movement capability of at least plus/minus 25 percent and non-staining to stone when tested in accordance with ASTM C1248.

2.04 STONE FABRICATION

A. Thickness: 3/4 inch (18 mm).

B. Fabrication Tolerances: In accordance with NBGQA (SPEC).

C. Fabricate units for uniform coloration between adjacent units and over the full area of the installation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that support work and site conditions are ready to receive work of this section.

B. Verify that items built-in under other sections are properly located and sized.

3.02 PREPARATION

A. Clean stone prior to erection. Do not use wire brushes or implements that will mark or damage exposed surfaces.

3.03 INSTALLATION

A. Set stone with a consistent joint width of 3/8 inch (9 mm).

B. Install anchors and place setting buttons to support stone and to establish joint dimensions.

C. Joints in Exterior Work: Seal joints with joint sealant over backer rod, following sealant manufacturer's instructions; tool sealant surface to concave profile.

D. Joints in Interior Work: Leave perimeter joints and expansion joints open for sealant; fill other joints with pointing mortar; pack and work into voids; tool surface to concave joint.

3.04 TOLERANCES

A. Positioning of Elements: Maximum 1/4 inch (6 mm) from true position.

B. Maximum Variation from Plane of Wall: 1/4 inch in 10 feet (6 mm in 3 m); 1/2 inch in 50 feet (13 mm in 15 m).

C. Maximum Variation Between Face Plane of Adjacent Panels: 1/16 inch (1.5 mm).

D. Maximum Variation from Plumb: 1/4 inch (6 mm) per story non-cumulative; 1/2 inch (13 mm) in any two stories.

E. Maximum Variation from Level Coursing: 1/8 inch in 3 feet (3 mm/m); 1/4 inch in 10 feet (6 mm in 3 m); 1/2 inch (13 mm) maximum.

F. Maximum Variation of Joint Thickness: 1/8 inch in 3 feet (3 mm/m).

3.05 CUTTING AND FITTING

A. Obtain approval prior to cutting or fitting any item not so indicated on drawings.

B. Do not impair appearance or strength of stone work by cutting.

3.06 CLEANING

A. Remove excess joint material upon completion of work.

B. Clean soiled surfaces with cleaning solution.

C. Use non-metallic tools in cleaning operations.

END OF SECTION

SECTION 04 4313
STONE MASONRY VENEER

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cut stone veneer at exterior walls.

B. Metal anchors and accessories.

C. Setting mortar.

1.02 RELATED REQUIREMENTS

A. Section 04 0511 - Mortar and Masonry Grout: Setting and pointing mortar.

B. Section 04 2000 - Unit Masonry: Joint reinforcement, Ties and Anchors.

C. Section 07 6200 - Sheet Metal Flashing and Trim: Flashings.

D. Section 07 9200 - Joint Sealants: Sealing joints indicated to be left open for sealant.

1.03 REFERENCE STANDARDS

A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries 2013.

B. ASTM A580/A580M - Standard Specification for Stainless Steel Wire 2016.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

D. ASTM C270 - Standard Specification for Mortar for Unit Masonry 2014a.

E. ASTM C503/C503M - Standard Specification for Marble Dimension Stone 2015.

F. ASTM C568/C568M - Standard Specification for Limestone Dimension Stone 2015.

G. ASTM C615/C615M - Standard Specification for Granite Dimension Stone 2018e1.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on stone units, [_____] , mortar, and reinforcement.

C. Samples: Submit two stone samples illustrating minimum and maximum stone sizes, [_____] , color range, texture, and markings.

D. Samples: Submit mortar color samples.

1.05 QUALITY ASSURANCE

A. Stone Fabricator Qualifications: Company specializing in fabricating cut stone with minimum ten years of experience.

B. Installer Qualifications: Company specializing in performing work of the type required by this section, with minimum [____] years of documented experience.

1.06 MOCK-UP

A. Construct stone wall mock-up, [____] feet ([____] m) long by [____] feet ([____] m) wide; include stone anchor accessories, corner condition and typical control joint in mock-up.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect stone from discoloration during storage on site.

1.08 FIELD CONDITIONS

A. Cold Weather Requirements: Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Stone Quarriers:

1. Champlain Stone, Ltd; [____]: www.champlainstone.com/#sle.
2. Vetter Stone Co; [____]: www.vetterstone.com/#sle.
3. [_____].
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Stone Masonry Reinforcement and Accessories

1. Blok-Lok Limited; [____]: www.blok-lok.com/#sle.
2. Hohmann & Barnard, Inc; [____]: www.h-b.com/#sle.
3. [_____].
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 STONE

A. Limestone: Indiana Oolitic Limestone; complying with ASTM C568/C568M Classification I - Low Density.

B. Marble: [_____] variety; complying with ASTM C503/C503M, Classification I - Calcite.

C. Granite: [_____] variety; complying with ASTM C615/C615M.

D. Stone: [_____] type, [_____] variety.

E. Surface Texture: Split face.

2.03 MORTAR

A. Setting Mortar: ASTM C270, Type S, using the Proportion Method as specified in Section 04 0511.

1. Products:
   a. The QUIKRETE Companies; QUIKRETE® Veneer Stone Mortar – Polymer Modified : www.quikrete.com/#sle.
   b. [_____].
   c. [_____].
   d. Substitutions: See Section 01 6000 - Product Requirements.

B. Pointing Mortar: Type N as specified in Section 04 0511, and using the Property Method in ASTM C270.

2.04 ACCESSORIES

A. Horizontal Joint Reinforcement: As specified in Section 04 2000.

B. Wall Ties: Formed steel wire, at least [___] inch ([___] mm) diameter, stainless steel conforming to ASTM A580/A580M, eye and pintle type, with provision for vertical adjustment after attachment.

C. Other Anchors in Direct Contact with Stone: ASTM A666 Type 304, stainless steel, of sizes and configurations required for support of stone and applicable superimposed loads.

D. Setting Buttons and Shims: Lead.

E. Flashings: [_____] type as specified in Section 07 6200.

F. Weep/Cavity Vents: Polyethylene tubing.

G. Back Coating:

1. Bituminous.

2. Cementitious parging of mortar to a minimum thickness of [____] inch ([____] mm).

H. Cleaning Solution: Type that will not harm stone, joint materials, or adjacent surfaces.

2.05 STONE FABRICATION

A. Fabricate for 3/8 inch (10 mm) beds and joints.

B. Bed and Joint Surfaces:

C. Form stone corners to irregular joint profile. Clean jagged corners from stone in preparation for setting.

D. Slope exposed top surfaces of stone and horizontal sill surfaces for shedding water.

E. Cut drip slot in bottom surface of work projecting more than 1/2 inch (13 mm) over window frame. Size slot not less than 3/8 inch (10 mm) wide and 1/4 inch (6 mm) deep for full width of projection.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that support work and site conditions are ready to receive work of this section.

B. Verify that items built-in under other sections are properly located and sized.

3.02 PREPARATION

A. Establish lines, levels, and coursing. Protect from disturbance.

B. Clean stone prior to erection. Do not use wire brushes or implements that mark or damage exposed surfaces.

C. Coat back surfaces not to be in contact with setting mortar with back coating material. Allow coating to cure.

3.03 INSTALLATION

A. Install flashings of longest practical length and seal watertight to back-up. Lap end joints minimum 6 inches (150 mm) and seal watertight.

B. Size stone units to fit opening dimensions and perimeter conditions.

C. Provide setting and pointing mortar in accordance with Section 04 0511.

1. If water is lost by evaporation, re-temper mortar only within two hours after mixing.

2. At ambient air temperature 80 degrees F (26 degrees C) and above, use mortar within two hours after mixing; at ambient air temperature below 50 degrees F (10 degrees C), use mortar within two-and-one-half hours after mixing.

D. Fill dowel holes in stone units with mortar.

E. Arrange stone coursing in running bond with consistent joint width.

F. Set stone in full mortar setting bed to fully support stone over bearing surface. Use setting buttons or shims to maintain correct joint width.

G. Install weep/cavity vents in vertical stone joints at [____] inches ([____] mm) on center horizontally; immediately above horizontal flashings, above shelf angles and supports and at top of each cavity space; do not permit mortar accumulation in cavity space.

3.04 REINFORCEMENT AND ANCHORAGE

A. Install horizontal joint reinforcement 16 inches (400 mm) on center.

B. Place horizontal joint reinforcement in first and second [_____] horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of opening.

C. Place joint reinforcement continuous in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches (150 mm).

E. In addition, place wall ties at maximum 3 inches (75 mm) on center each way around perimeter of openings, within 12 inches (300 mm) of openings.

3.05 JOINTS

A. Leave the following joints open for sealant:

1. Head joints in top courses, including copings, parapets, cornices, sills, and steps.
2. Joints in projecting units.
3. Joints between rigidly anchored units, including soffits, panels, and column covers.
4. Joints below lugged sills and stair treads.
5. Joints below ledge and relieving angles.
6. Joints labeled "expansion joint".

B. Rake out mortar joints 5/8 to 3/4 inch (16 to 19 mm) and brush joints clean to accommodate pointing mortar. Fill joints with pointing mortar.

C. Pack mortar into joints and work into voids. Neatly tool surface to concave joint.

D. At joints to be sealed, clean mortar out of joint before it sets. Brush joints clean.

3.06 CLEANING

A. Remove excess mortar as work progresses, and upon completion of work.

B. Clean soiled surfaces with cleaning solution.

C. Use non-metallic tools in cleaning operations.

3.07 PROTECTION

A. During temporary storage on site, at the end of working day, and during rainy weather, cover stone work exposed to weather with non-staining waterproof coverings, securely anchored.

END OF SECTION

SECTION 04 0100
MAINTENANCE OF MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water cleaning of surfaces.

B. Replacement of units.

C. Repointing mortar joints.

D. Repair of damaged masonry.

1.02 RELATED REQUIREMENTS

A. Section 04 0511 - Mortar and Masonry Grout.

B. Section 04 2000 - Unit Masonry: Brick masonry units.

C. Section 04 2000 - Unit Masonry: Mortar and grout.

D. Section 04 2001 - Masonry Veneer.

E. Section 04 2600 - Single-Wythe Unit Masonry.

F. Section 04 4200 - Exterior Stone Cladding.

G. Section 04 4313 - Stone Masonry Veneer.

1.03 REFERENCE STANDARDS

A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries 2013.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work of this section.

1. Require attendance of parties directly affecting work of this section.

2. Review conditions of installation, installation procedures, and coordination with related work.

B. Scheduling:

1. Perform cleaning and washing of masonry between the hours of 7 am to 11 pm only.

2. Perform blast cleaning of masonry between the hours of 7 am to 11 pm only.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate setting details of stone. Detail shoring.

C. Product Data: Provide data on cleaning compounds.

D. Samples: Submit four samples of decorative block, face brick and stone units to illustrate matching color, texture and extremes of color range.

E. Manufacturer's Instructions: For cleaning materials, indicate special procedures, conditions requiring special attention.

1.06 QUALITY ASSURANCE

A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of the contract documents.

1. Maintain one copy of each document on project site.

B. Restorer: Company specializing in masonry restoration with minimum Five years of documented experience.

1.07 MOCK-UP

A. Restore and repoint an existing masonry wall area sized 8 feet (2.40 m) long by 6 feet (2 m) high; include in mock-up area instances of mortar, accessories, wall openings and flashings.

B. Clean a 10 ft (3 m) by 10 ft (3 m) panel of wall to determine extent of cleaning.

1. Repeat, using different cleaning methods for up to three different panels.

C. Locate where directed.

D. Acceptable panel and procedures employed will become the standard for work of this section.

E. Mock-up may remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver masonry neatly stacked and tied on pallets. Store clear of ground with adequate waterproof covering.

B. Store blast medium materials in manufacturer's packaging.

1.09 FIELD CONDITIONS

A. Cold and Hot Weather Requirements: Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.

B. Do not blast clean or use process creating dust, dirt, when wind is over 10 mph (16 kph).

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Restoration and Cleaning Chemicals:

1. Diedrich Technologies, Inc: www.diedrichtechnologies.com/#sle.
2. HMK Stone Care System: www.hmkstonecare.com/#sle.
3. PROSOCO: www.prosoco.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 CLEANING MATERIALS

A. Cleaning Agent: Detergent type.

B. Cleaning Agent: 0.5 lb (227 g) of mixture to one gallon (3.8 L) of water.

C. Acid Solution: Clean, stain free, commercial hydrochloric (muriatic) acid, mixed one part to 10 parts of potable water.

D. Blasting Medium: .

2.03 MORTAR MATERIALS

A. Comply with requirements of Section 04 0511.

2.04 MASONRY MATERIALS

A. Brick: Section 04 2000.

B. Stone Veneer: Section 04 4200.

C. Terra Cotta: Section .

D. Block: Section 04 2000.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces to be cleaned are ready for work of this section.

3.02 PREPARATION

A. Protect surrounding elements from damage due to restoration procedures.

B. Carefully remove and store removable items located in areas to be restored, including fixtures, fittings, finish hardware and accessories; reinstall upon completion.

C. Separate areas to be protected from restoration areas using means adequate to prevent damage.

D. Cover existing landscaping with tarpaulins or similar covers.

E. Mask immediately adjacent surfaces with material that will withstand cleaning and restoration procedures.

F. Close off adjacent occupied areas with dust proof and weatherproof partitions.

G. Protect roof membrane and flashings from damage with 1/2 inch (13 mm) plywood laid on roof surfaces over full extent of work area and traffic route.

H. When using cleaning methods that involve water or other liquids, install drainage devices to prevent runoff over adjacent surfaces unless those surfaces are impervious to damage from runoff.

I. Do not allow cleaning runoff to drain into sanitary or storm sewers.

3.03 REBUILDING

A. Cut out damaged and deteriorated masonry with care in a manner to prevent damage to any adjacent remaining materials.

B. Support structure as necessary in advance of cutting out units.

C. Cut away loose or unsound adjoining masonry as directed.

D. Build in new units following procedures for new work specified in other section(s).

E. Mortar Mix: Colored and proportioned to match existing work.

F. Ensure that anchors are correctly located and built in.

G. Install built in masonry work to match and align with existing, with joints and coursing true and level, faces plumb and in line. Build in all openings, accessories and fittings.

3.04 REPOINTING

A. Perform repointing prior to cleaning masonry surfaces.

B. Cut out loose or disintegrated mortar in joints to minimum 1/2 inch (6 mm) depth or until sound mortar is reached.

C. Use power tools only after test cuts determine no damage to masonry units will result.

D. Do not damage masonry units.

E. When cutting is complete, remove dust and loose material by brushing.

F. Premoisten joint and apply mortar. Pack tightly in maximum 1/4 inch (6 mm) layers. Form a smooth, compact concave joint to match existing.

G. Moist cure for 72 hours.

3.05 CLEANING NEW MASONRY

A. Verify mortar is fully set and cured.

B. Clean surfaces and remove large particles with wood scrapers, brass or nylon wire brushes.

C. Scrub walls with cleaning agent solution using stiff brush. Thoroughly rinse and wash off cleaning solution, dirt and mortar crumbs using clean, pressurized water.

D. Use acid solution mixed with water in accordance with manufacturer's instructions. Apply acid solution and scrub masonry with stiff fiber brushes. Do not scrub the mortar joints.

E. Protect area below cleaning operation and keep masonry soaked with water and flushed free of acid and dissolved mortar continuously for duration of cleaning.

F. Before solution dries, rinse and remove acid solution and dissolved mortar, using clean, pressurized water.

3.06 RESTORATION CLEANING

A. Clean surfaces and remove large particles with wood scrapers or non-ferrous wire brush.

B. Spray coat masonry with restoration cleaner, mixed into solution in accordance with manufacturer's instructions.

C. Provide a second application if required to match mock-up area.

D. Allow sufficient time for solution to remain on masonry and agitate with soft fiber brush or sponge.

E. Rinse from the bottom up with potable water applied at 400 psi (2 750 kPa) and at a rate of 4 gal/min (16 L/min).

3.07 AGING

A. Rub in new masonry work to match, as close as possible, adjacent original work.

1. Use carbon black in small amounts, rubbing in well with burlap rags.

B. After each application, dust off surplus and wash down with low pressure hose. Allow surface to dry before proceeding with succeeding applications.

C. Continue process until acceptance.

3.08 CLEANING

A. Immediately remove stains, efflorescence, or other excess resulting from the work of this section.

B. Remove excess mortar, smears, and droppings as work proceeds and upon completion.

C. Clean surrounding surfaces.

END OF SECTION

SECTION 05 1200
STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Structural steel framing members.

B. Structural steel support members and struts.

C. Base plates, shear stud connectors and expansion joint plates.

D. Grouting under base plates.

1.02 RELATED REQUIREMENTS

A. Section 05 1213 - Architecturally-Exposed Structural Steel Framing: Additional requirements for structural steel members designated as architecturally-exposed structural steel (AESS).

B. Section 05 2100 - Steel Joist Framing.

C. Section 05 3100 - Steel Decking: Support framing for small openings in deck.

D. Section 05 5000 - Metal Fabrications: Steel fabrications affecting structural steel work.

E. Section 07 8100 - Applied Fireproofing: Fireproof protection to framing and metal deck systems.

F. Section 31 3116 - Termite Control: Field-applied termiticide and mildewcide for structural steel.

1.03 PRICE AND PAYMENT PROCEDURES

A. See Section 01 2200 - Unit Prices, for additional unit price requirements.

B. Structural Steel Framing:

1. Basis of Measurement: By the ton (metric ton).

2. Basis of Payment: Includes structural members fabricated, placed and anchored.

1.04 REFERENCE STANDARDS

A. AISC (MAN) - Steel Construction Manual 2017.

B. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges 2016.

C. ASTM A1 - Standard Specification for Carbon Steel Tee Rails 2000 (Reapproved 2018).

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2018.

F. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished 2018.

G. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

H. ASTM A242/A242M - Standard Specification for High-Strength Low-Alloy Structural Steel 2013 (Reapproved 2018).

I. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2014 (Editorial 2017).

J. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2013.

K. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2014.

L. ASTM A514/A514M - Standard Specification for High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding 2014.

M. ASTM A529/A529M - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality 2014.

N. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts 2015.

O. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts (Metric) 2007 (Reapproved 2013).

P. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel 2015.

Q. ASTM A759 - Standard Specification for Carbon Steel Crane Rails 2010 (Reapproved 2016).

R. ASTM A992/A992M - Standard Specification for Structural Steel Shapes 2011 (Reapproved 2015).

S. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable 2018.

T. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.

U. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink) 2014a.

V. ASTM C827/C827M - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures 2016.

W. ASTM E94/E94M - Standard Guide for Radiographic Examination Using Industrial Radiographic Film 2017.

X. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments 2013.

Y. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions 2015a.

Z. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions 2018a.

AA. ASTM F959/F959M - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners, Inch and Metric Series 2017a.

BB. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength 2018.

CC. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2012.

DD. AWS D1.1/D1.1M - Structural Welding Code - Steel 2015, with Errata (2016).

EE. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel 2017.

FF. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections 2014, with Errata (2015).

GG. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 1999 (Ed. 2004).

HH. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).

II. SSPC-SP 3 - Power Tool Cleaning 1982, with Editorial Revision (2004).

JJ. SSPC-SP 5 - White Metal Blast Cleaning 2007.

KK. SSPC-SP 6 - Commercial Blast Cleaning 2007.

LL. SSPC-SP 7 - Brush-Off Blast Cleaning 2007.

MM. SSPC-SP 13 - Surface Preparation of Concrete 1997 (Reaffirmed 2003).

NN. UL (FRD) - Fire Resistance Directory Current Edition.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:

1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments and fasteners.
2. Connections not detailed.
3. Indicate cambers and loads.
4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.

C. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.

D. Mill Test Reports: Indicate structural strength, destructive test analysis and non-destructive test analysis.

E. Fabricator Test Reports: Comply with ASTM A1011/A1011M.

F. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

G. Designer's Qualification Statement.

H. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.06 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."

B. Structural steel members designated as architecturally-exposed structural steel (AESS) to also comply with Section 05 1213.

C. Maintain one copy of each document on site.

D. Fabricator: Company specializing in performing the work of this section with minimum five years of documented experience.

E. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.

F. Erector: Company specializing in performing the work of this section with minimum five years of documented experience.

G. Design connections not detailed on drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in Maryland.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

2.02 MATERIALS

A. Steel Angles and Plates: ASTM A36/A36M.

B. Steel W Shapes and Tees: ASTM A992/A992M.

C. Rolled Steel Structural Shapes: ASTM A992/A992M.

D. Steel Shapes, Plates and Bars: ASTM A529/A529M high-strength, carbon-manganese structural steel, Grade 50.

E. Crane Rails: ASTM A1, ; cross section and length as indicated on drawings.

F. Crane Rails: ASTM A759, ; cross section and length as indicated on drawings.

G. Steel Plates and Bars: ASTM A572/A572M, Grade 50 (345) high-strength, columbium-vanadium steel.

H. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade B.

I. Hot-Formed Structural Tubing: ASTM A501/A501M, seamless or welded.

J. Steel Bars: ASTM A108.

K. Steel Plate: ASTM A514/A514M.

L. Steel Sheet: ASTM A1011/A1011M, Designation SS, Grade 30 hot-rolled, or ASTM A1008/A1008M, Designation SS, Grade 30 cold-rolled.

M. Pipe: ASTM A53/A53M, Grade B, Finish black.

N. Shear Stud Connectors: Made from ASTM A108 Grade 1015 bars.

O. Sag Rods: ASTM A36/A36M.

P. Structural Bolts and Nuts: Carbon steel, ASTM A307, Grade A and galvanized in compliance with ASTM A153/A153M Class C.

Q. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563 or ASTM A563M nuts and ASTM F436/F436M washers.

R. Tension Control Bolts: Twist-off type; ASTM F3125/F3125M.

S. Unheaded Anchor Rods: ASTM F1554, Grade 36, plain, with matching ASTM A563 or ASTM A563M nuts and ASTM F436/F436M Type 1 washers.

T. Headed Anchor Rods: ASTM A307 Grade C, plain.

U. Load Indicator Washers: Provide washers complying with ASTM F959/F959M at connections requiring high-strength bolts.

V. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

W. Sliding Bearing Plates: Teflon coated.

X. Grout: ASTM C1107/C1107M; Non-shrink; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.

   1. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch (13.7 MPa).
   2. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch (48 MPa).
   3. Height Change, Plastic State; when tested according to ASTM C827/C827M:
      a. Maximum: Plus 4 percent.
      b. Minimum: Plus 1 percent.

Y. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

Z. Touch-Up Primer for Galvanized Surfaces: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

2.03 FABRICATION

A. Shop fabricate to greatest extent possible.

B. Continuously seal joined members by continuous welds. Grind exposed welds smooth.

C. Fabricate connections for bolt, nut, and washer connectors.

D. Develop required camber for members.

2.04 FINISH

A. Prepare structural component surfaces in accordance with SSPC-SP 3.

B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete or high strength bolted.

2.05 SOURCE QUALITY CONTROL

A. Provide shop testing and analysis of structural steel.

B. High-Strength Bolts: Provide testing and verification of shop-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts", testing at least ten percent of bolts at each connection.

C. Welded Connections: Visually inspect all shop-welded connections and test at least ten percent of welds using one of the following:

1. Radiographic testing performed in accordance with ASTM E94/E94M.
2. Ultrasonic testing performed in accordance with ASTM E164.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.02 ERECTION

A. Erect structural steel in compliance with AISC 303.

B. Allow for erection loads, and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.

C. Field weld components and shear studs indicated on shop drawings.

D. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on drawings. Install high-strength bolts in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts".

E. Do not field cut or alter structural members without approval of Architect .

F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

G. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

3.03 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

3.04 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.

B. High-Strength Bolts: Provide testing and verification of field-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts", testing at least ten percent of bolts at each connection.

C. Welded Connections: Visually inspect all field-welded connections and test at least ten percent of welds using one of the following:

1. Radiographic testing performed in accordance with ASTM E94/E94M.
2. Ultrasonic testing performed in accordance with ASTM E164.

END OF SECTION

SECTION 05 1213
ARCHITECTURALLY-EXPOSED STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Additional requirements for structural steel members designated as architecturally-exposed structural steel (AESS).

1.02 RELATED REQUIREMENTS

A. Section 05 1200 - Structural Steel Framing: General requirements for structural steel members, including AESS framing specified in this section.

B. Section 05 2100 - Steel Joist Framing: Alignment and location of bridging where joists are visible.

C. Section 05 3100 - Steel Decking: Erection requirements relating to exposed steel decking and its connections.

D. Section 05 5000 - Metal Fabrications: Loose steel bearing plates and miscellaneous steel framing.

E. Section 07 8100 - Applied Fireproofing: Fireproof protection to framing and metal deck systems.

F. Section 09 9113 - Exterior Painting: Finish coat requirements and coordination with primer and surface preparation specified in this section.

G. Section 09 9123 - Interior Painting: Finish coat requirements and coordination with primer and surface preparation specified in this section.

H. Section 09 9600 - High-Performance Coatings: Finish coat requirements and coordination with primer and surface preparation specified in this section.

1.03 DEFINITIONS

A. Architecturally-Exposed Structural Steel: Structural steel complying with designated AESS category as defined in AISC 303.

1.04 REFERENCE STANDARDS

A. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges 2016.

B. AISC 360 - Specification for Structural Steel Buildings 2016.

C. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling 2017.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

E. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2013.

F. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings 2009 (Reapproved 2015).

G. ASTM A1085/A1085M - Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS) 2015.

H. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions 2015a.

I. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2012.

J. AWS D1.1/D1.1M - Structural Welding Code - Steel 2015, with Errata (2016).

K. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).

L. SSPC-SP 6 - Commercial Blast Cleaning 2007.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Schedule and conduct a preinstallation meeting at project site one week prior to start of work of this section; require attendance by all affected installers. Coordinate requirements for shipping, special handling, storage, attachment of safety cables and temporary erection bracing, final coating, touch-up painting, mock-up coordination, Architect's observations, and other requirements for AESS.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product data for each type of product specified. Submit paint systems in accordance with Section 09 9113.

C. Shop Drawings: Detailing for fabrication of AESS components.

1. Provide erection documents clearly indicating which members are AESS members and the AESS category of each part.

2. Include details that clearly identify AESS requirements found in this specification. Provide connections for AESS consistent with concepts shown on drawings.

3. Indicate welds by AWS A2.4 symbols, distinguishing between shop and field welds, and show size, length and type of each weld. Identify grinding, finish and profile of welds as defined by the designated AESS category.

4. Indicate orientation of hollow structural section (HSS) seams and mill marks (where applicable).

5. Indicate type, size, finish and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted slip-critical, direct-tensioned shear/bearing connections. Indicate orientation of bolt heads.

6. Indicate which surfaces or edges are exposed and what class of surface preparation is being used.

7. Indicate special tolerances and erection requirements as noted on drawings or defined by the designated AESS category.

8. Indicate vent or drainage holes for HSS members.

D. AESS 1, AESS 2, AESS 3, AESS 4 and AESS C Samples: Provide samples of specific AESS characteristics. Samples may be small size samples or components of conventional structural steel demonstrating specific AESS characteristics, including surface preparation, sharp edges ground smooth, continuous weld appearance, weld show through and fabrication mark removal.

E. Qualification data for fabricator and erector to demonstrate their capabilities and experience. Include lists of completed projects names and address, names and addresses of architects and owners, photographs showing detail of installed AESS and other information specified.

1.07 QUALITY ASSURANCE

A. Fabricator Qualifications: In addition to those qualifications listed in Section 05 1200, engage an AISC Certified Fabricator, experienced in fabricating AESS similar to that indicated for this project with a record of successful in-service performance, as well as sufficient production capacity to fabricate AESS without delaying the work.

B. Erector Qualifications: In addition to those qualifications listed in Section 05 1200, engage an AISC Certified Erector, experienced in erecting AESS work similar in material, design, and extent to that indicated for this project and with a record of successful in-service performance.

C. Comply with applicable provisions of AISC 303, Section 10 for the designated AESS category.

D. Contractor to engage a quality assurance agency per requirements of AISC 360, Chapter N and AISC 303, Section 10.

1.08 MOCK-UP

A. Provide mock-ups for AESS 3, AESS 4 and AESS C of nature and extent indicated in contract documents.

B. See Section 01 4000 - Quality Requirements for additional requirements.

C. Locate mock-ups in fabricator's shop. Mock-ups to be full-size unless Architect approves smaller models. Alternatively, when a mock-up is not practical, the first piece of an element or connection can be used to determine acceptability.

D. Notify Architect one week in advance of dates and times when mock-ups will be available for review.

E. Demonstrate applicable AESS characteristics for specified category of AESS on elements and joints in mock-up.

F. Build mock-ups using member sizes and materials indicated for final work.

G. Mock-up to demonstrate weld quality, contouring of welds at aligned walls of members, specified surface preparation and finish coating.

H. HSS members to extend at least 6 inches (152.4 mm) from joint in mock-up.

I. Obtain Architect’s written approval of mock-ups before starting fabrication.

J. Retain and maintain mock-ups during construction in an undisturbed condition as a standard for judging completed work.

K. Approved mock-ups in an undisturbed condition at Date of Substantial Completion may become part of completed work.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Handle finished pieces in accordance with Section 10 of AISC 303, using nylon-type slings, or chains with softeners, or wire ropes with softeners such that they are not damaged.

B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration. Use special care in handling to prevent twisting or warping of AESS members.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Comply with Section 05 1200, except as amended in this section for aesthetic purposes.

B. Comply with AISC 303, Section 10 for specific AESS category designated on drawings.

2.02 FABRICATION

A. Fabricate and assemble AESS in shop to greatest extent possible. Locate field joints in AESS assemblies at concealed locations or as approved by Architect. Detail AESS assemblies to minimize field handling and expedite erection.

B. Permissible tolerances for member depth, width, out of square, and camber and sweep to be as specified in ASTM A6/A6M, ASTM A500/A500M, and ASTM A1085/A1085M.

C. For curved structural members, whether composed of a single standard structural shape or built-up, the as-fabricated variation from theoretical curvature to be equal to or less than standard camber and sweep tolerances permitted for straight members in applicable ASTM standard.

D. Use special care in handling and shipping of AESS both before and after shop painting to minimize damage to any shop finish. Use nylon-type slings or softeners when using chains or wire rope slings.

E. Bolted Connections:

1. Make in accordance with Section 05 1200. Provide bolt type and finish as noted herein.

F. Welded Connections:

1. Comply with AWS D1.1/D1.1M and Section 05 1200.
2. Assemble and weld built-up sections by methods that will maintain alignment of members without warp exceeding tolerances of this section.

G. Surface Preparation:

1. Remove blemishes or unsightly surfaces resulting from temporary braces or fixtures.
2. Remove backing and run out tabs.

H. Fabricate AESS in accordance with categories defined in AISC 303, as follows:

1. AESS 1: Basic elements.
2. AESS 2: Feature elements viewed at a distance greater than 20 feet (6 m) (feature elements not in close view).
3. AESS 3: Feature elements viewed at a distance less than 20 feet (6 m) (feature elements in close view).
4. AESS 4: Showcase elements with special surface and edge treatment beyond fabrication (showcase elements).

2.03 PAINT SYSTEM

A. Compatibility: All components/procedures of AESS paint system to comply with coating system specified, submitted, and approved per Sections 09 9113, 09 9123 and 09 9600. As a minimum, identify required surface preparation, primer, intermediate coat (if applicable), and finish coat. Primer, intermediate coating, and finish coating to be from a single manufacturer combined in a system documented by manufacturer with adequate guidance for fabricator to procure and execute.

B. Primer: As specified in Sections 09 9113, 09 9123 and 09 9600. Primer to comply with all federal standards for VOC, lead and chromate levels.

C. Finish Coating: Field apply intermediate and top coats per Sections 09 9113, 09 9123 and 09 9600.

2.04 SHOP PRIMING

A. Surface Preparation:

1. Provide surface preparations to meet SSPC-SP 6.
2. Coordinate required surface profile with approved paint submittal prior to beginning surface preparation.
3. Prior to blasting, remove any grease and oil using solvent cleaning to meet SSPC-SP 1.
4. Remove weld spatter, slivers and similar surface discontinuities.
5. Ease sharp corners resulting from shearing, flame cutting or grinding.

B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete or high strength bolted with slip-critical connections.

1. Extend priming of members partially embedded in concrete or mortar to a depth of 2 inches (50.8 mm).

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's instructions to provide a dry film thickness of not less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2. Apply two coats of shop primer to surfaces that are inaccessible after assembly or erection.

2.05 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by hot-dip process to AESS indicated for galvanizing according to ASTM A123/A123M. Fabricate such that all connections of assemblies are made in the field with bolted connections where possible.

2.06 MATERIALS

A. General: Meet requirements of 05 1200 as amended below.

B. Tension Control, High-Strength Bolts, Nuts, and Washers: Per section 05 1200, Tension Control Bolts. Provide standard carbon steel finish rounded bolt heads with twist off bolts; ASTM F3125/F3125M.

2.07 SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Structural Requirements:

1. Comply with quality control requirements per AISC 360, Chapter N and AISC 303, Section 10. Refer to Section 05 1200 for additional requirements.

2. Quality assurance agency to review work for compliance with requirements of AISC 360, Chapter N and AISC 303, Section 10.

C. AESS 1 and 2 Acceptance: Architect to observe AESS in the shop at a viewing distance consistent with final installation and determine acceptability based on qualification data and submittals. Quality assurance agency has no responsibility for enforcing requirements related to aesthetic effect.

D. AESS 3,4, and C Acceptance: Architect to observe AESS in the shop at a viewing distance consistent with final installation and determine acceptability based on approved mock-up. Quality assurance agency has no responsibility for enforcing requirements related to aesthetic effect.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Erector to check all AESS members upon delivery for twist, kinks, gouges or other imperfections which may result in rejection of appearance of member. Coordinate remedial action with fabricator prior to erecting steel.

3.02 PREPARATION

A. Provide connections for temporary shoring, bracing and supports only where noted on approved fabrication documents. Temporary connections not shown are to be made at locations not exposed to view in final structure or as approved by Architect.

B. Handle, lift and align pieces using nylon straps or chains with softeners required to maintain appearance of AESS through process of erection.

3.03 ERECTION

A. AESS 1 and 2: Basic elements; feature elements not in close view:

1. Employ special care to handle and erect AESS. Erect finished pieces using nylon straps or chains with softeners such that they are not damaged.
2. Place weld tabs for temporary bracing and safety cabling at points concealed from view in completed structure or where approved by Architect during pre-installation meeting. Obtain Architect approval of methods for removing temporary devices and finishing AESS members prior to erection.
3. AESS Erection Tolerances: Erect to standard frame tolerances for structural steel per Chapter 7 of AISC 303.
4. Set AESS accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
5. Remove blemishes or unsightly surfaces resulting from temporary braces or fixtures.
6. Remove all backing and run out tabs.
7. When temporary braces or fixtures are required to facilitate erection, take care to avoid any blemishes, holes or unsightly surfaces resulting from use or removal of such temporary elements.
8. Bolted Connections: Align bolt heads on same side of connection as indicated on approved fabrication or erection documents.
9. Welded Connections: Comply with AWS D1.1/D1.1M and Section 05 1200. Appearance and quality of welds to be consistent. Employ methods that will maintain alignment of members without warp exceeding tolerance of this section.
10. Remove weld spatter exposed to view.
11. Grind off projections larger than 1/16 inch (1.5875 mm) at field butt and plug welds.
12. Continuous Welds: Where continuous welding is noted on drawings, provide continuous welds of a uniform size and profile.
13. Do not enlarge holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts. Replace connection plates that are misaligned where holes cannot be aligned with acceptable final appearance.
14. Splice members only where indicated.
15. Obtain permission for any torch cutting or field fabrication from Architect. Finish sections thermally cut during erection to a surface appearance consistent with mock-up.

B. AESS 3: Feature elements in close view:

1. Erect to requirements of AESS 1 and 2 and as follows:
2. Field Welding: Weld profile, quality, and finish to be consistent with mock-ups approved prior to fabrication.

C. AESS 4: Showcase elements:

1. Erect to requirements of AESS 3 and as follows:
2. Grind welds smooth.
3. Minimize Weld Show Through: At locations where welding on far side of an exposed connection creates distortion, grind distortion and marking of steel to a smooth profile with adjacent material.
4. Filling of Weld Access Holes: Where holes must be cut in web at intersection with flanges on W shapes and structural tees to permit field welding of flanges, fill holes with joint filler.

5. Where welds are indicated to be ground, contoured, or blended, oversize welds as required and grind to provide a smooth transition and match profile on approved mock-up.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Structural Requirements:

1. Comply with quality control requirements per AISC 360, Chapter N and AISC 303, Section 10. Refer to Section 05 1200 for additional requirements.

2. Quality assurance agency to review work for compliance with requirements of AISC 360, Chapter N and AISC 303, Section 10.

C. AESS 1 and 2 Acceptance: Architect to observe AESS in place and determine acceptability based on qualification data and submittals. Quality assurance agency has no responsibility for enforcing requirements related to aesthetic effect.

D. AESS 3,4, and C Acceptance: Architect to observe AESS in place and determine acceptability based on qualification data and submittals as well as on approved mock- up. Quality assurance agency has no responsibility for enforcing requirements related to aesthetic effect.

3.05 CLEANING

A. Touch-up Painting: Complete cleaning and touch-up painting of field welds, bolted connections, and abraded areas of shop paint to blend with adjacent surfaces of AESS. Perform touch-up work in accordance with manufacturer's instructions and as specified in Section 09 9113, 09 9123 and 09 9600.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas. Repair galvanized surfaces in accordance with ASTM A780/A780M.

C. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

END OF SECTION

SECTION 05 2100
STEEL JOIST FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Open web steel joists, with bridging, attached seats and anchors.

B. Loose bearing members, such as plates or angles, and anchor bolts for site placement.

C. Supplementary framing for floor and roof openings greater than 18 inches (450 mm).

1.02 RELATED REQUIREMENTS

A. Section 05 1200 - Structural Steel Framing: Grouting base plates and bearing plates. Superstructure framing.

B. Section 05 1200 - Structural Steel Framing: Superstructure framing.

C. Section 05 3100 - Steel Decking: Bearing plates and angles.

D. Section 05 3100 - Steel Decking: Support framing for openings less than 18 inches (450 mm) in decking.

E. Section 05 5000 - Metal Fabrications: Non-framing steel fabrications attached to joists.

F. Section 06 1736 - Metal-Web Wood Joists: Support framing for openings less than 18 inches (450 mm) in decking.

G. Section 07 8100 - Applied Fireproofing: Fireproof protection of joist framing and metal deck systems.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

C. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2014 (Editorial 2017).

D. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts 2015.

E. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts (Metric) 2007 (Reapproved 2013).

F. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments 2013.

G. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions 2015a.

H. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification 2014 (Amended 2015).

I. AWS D1.1/D1.1M - Structural Welding Code - Steel 2015, with Errata (2016).

J. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel 2017.

K. ITS (DIR) - Directory of Listed Products current edition.

L. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections 2014, with Errata (2015).

M. SJI 100 - Catalog of Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders 2011.

N. SJI Technical Digest No. 9 - Handling and Erection of Steel Joists and Joist Girders 2008.

O. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 1999 (Ed. 2004).

P. SSPC-SP 2 - Hand Tool Cleaning 1982, with Editorial Revision (2004).

Q. SSPC-SP 3 - Power Tool Cleaning 1982, with Editorial Revision (2004).

R. UL (FRD) - Fire Resistance Directory Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate standard designations, joist coding, configurations, sizes, spacings, cambers, locations of joists, joist leg extensions, bridging, connections and attachments.

C. Welders' Certificates: Submit manufacturer's certificates, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

D. Designer's Qualification Statement.

E. Manufacturer's Qualification Statement.

F. Erector's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Design connections not detailed on drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in Maryland.

B. Perform Work, including that for headers and other supplementary framing, in accordance with SJI 100 Standard Specifications Load Tables and SJI Technical Digest No. 9.

1. Maintain one copy of document on site.

C. Design and Installation Requirements: Comply with UL (FRD) Assembly Design No. .

D. Manufacturer Qualifications: Company specializing in performing the work of this section with minimum ten years documented experience.

E. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Transport, handle, store, and protect products to SJI requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Steel Joists:

1. Canam Group Inc: www.canam-steeljoists.ws

2. Nucor-Vulcraft Group: www.vulcraft.com/#sle.

3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Open Web Joists: SJI Type K Joists:

1. Minimum End Bearing on Steel Supports: Comply with referenced SJI standard.

2. Minimum End Bearing on Concrete or Masonry Supports: Comply with referenced SJI standard.

3. Finish: Shop primed.

B. Open Web Joists: SJI 100 Type LH Joists:
   1. Provide bottom chord extensions as indicated.
   2. Minimum End Bearing on Steel Supports: Comply with referenced SJI standards.
   3. Minimum End Bearing on Masonry or Concrete Supports: Comply with referenced SJI standards.
   4. Finish: Shop primed.

C. Open Web Joists: SJI 100 Type DLH Joists:
   1. Provide bottom chord extensions as indicated.
   2. Minimum End Bearing on Steel Supports: Comply with referenced SJI standards.
   3. Minimum End Bearing on Masonry or Concrete Supports: Comply with referenced SJI standards.
   4. Finish: Shop primed.

D. Open Web Composite Joists: SJI 100 Type CJ Joists:
   1. Provide bottom chord extensions as indicated.
   2. Minimum End Bearing on Steel Supports: Comply with referenced SJI standards.
   3. Minimum End Bearing on Masonry or Concrete Supports: Comply with referenced SJI standards.
   4. Finish: Shop primed.

E. Open Web Joists: SJI 100 Joist Girders:
   1. Provide bottom chord extensions as indicated.
   2. Minimum End Bearing on Steel Supports: Comply with referenced SJI standards.
   3. Minimum End Bearing on Masonry or Concrete Supports: Comply with referenced SJI standards.
   4. Finish: Shop primed.

F. Anchor Bolts, Nuts and Washers: ASTM A307 hot-dip galvanized per ASTM A153/A153M Class C.

G. Tension Control Bolts: Twist-off type; ASTM F3125/F3125M.

H. Structural Steel For Supplementary Framing and Joist Leg Extensions: ASTM A36/A36M.

I. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

J. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.03 FABRICATION

A. Drill holes in chords for attachment of wood nailers where indicated.

B. Frame special sized openings in joist web framing as detailed.

2.04 FINISH

A. Shop prime joists as specified.
   1. Do not prime surfaces that will be fireproofed.

B. Prepare surfaces to be finished in accordance with SSPC-SP 2.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions prior to beginning work.

3.02 ERECTION

A. Erect joists with correct bearing on supports.

B. Allow for erection loads. Provide sufficient temporary bracing to maintain framing safe, plumb, and in true alignment.

C. Coordinate the placement of anchors for securing loose bearing members furnished as part of the work of this section.

D. After joist alignment and installation of framing, field weld joist seats to steel bearing surfaces.

E. Install supplementary framing for floor and roof openings greater than 18 inches (450 mm).

F. Do not permit erection of decking until joists are braced, bridged, and secured or until completion of erection and installation of permanent bridging and bracing.

G. Do not field cut or alter structural members without approval of joist manufacturer.

3.03 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm).

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

3.04 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.

END OF SECTION

SECTION 05 3113
STEEL FLOOR DECKING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General Conditions and other Division 1 Specification Sections, apply to the Work of this Section.

1.02 RELATED GENERAL WORK

A. Structural Steel: Section 05120

B. Steel Joists: Section 05211

C. Metal Roof Deck: Section 05230

1.03 QUALITY ASSURANCE, CODES AND STANDARDS

A. Comply with the provisions of the following codes and standards, except as otherwise shown or specified:

1. Steel Deck Institute "SDI Manual of Construction with Steel Deck."
2. "SDI Design Manual for Composite Decks, Form Decks and Roof Decks - No. 30."
3. AISI "Specification for the Design of Cold-Formed Steel Structural Members" (Minimum yield point of 33 ksi).
4. AWS "Code for Welding in Building Construction."
5. AISC "Manual of Steel Construction."
6. ASTM A611 or A446 for sheet steel.
7. Job Site Safety: OSHA Regulation CFR 1926, Subparts M and R.

1.04 QUALIFICATION OF WELDING WORK

A. Qualify welding processes and welding operators in accordance with the AWS "Standard Qualification Procedure."

1.05 INSPECTION

A. Welding is subject to inspection as required by Prince George's County. The Owner will pay for all required testing by the Owner's testing and inspection agency. The Contractor shall be responsive for proper notification to the testing agency prior to performance of welding operations.

B. Expense of removing and replacing any portion of welded in place decking for testing purposes will be borne by the Owner if welds are found to be satisfactory. Remove and replace work found to be defective and not complying with requirements. Expense of replacing defective work shall be borne by the Contractor.

1.06 SUBMITTALS

A. Submit manufacturer's specifications and installation instructions for each product specified. Include manufacturer's certification to show compliance with these Specifications. Indicate by transmittal form that a copy of each instruction has been distributed to the Installer.

1.07 DELIVERY AND STORAGE

A. Deliver and store deck bundles in a location on the project site that will allow proper and safe access by the hoisting equipment to the building structure.

B. Protect bundles from weather and damage. Store above ground, covered, with one end of bundles elevated. Use ventilated, waterproof coverings to avoid condensation on deck surfaces.

C. Deck bundles shall be stacked in a manner to avoid tipping, sliding, or shifting while being stored.

D. Inspect bundle for tightness during storage. Provide additional securement if necessary.

PART 2 - PRODUCTS

2.01 STEEL FORM DECK (NON-COMPOSITE)

A. Provide corrugated steel form deck of at least 28 gauge uncoated material having a formed depth of at least 9/16", or as indicated on the Structural Drawings.

2.02 STEEL FLOOR DECK (COMPOSITE)

A. Provide composite steel floor deck of gauge and depth indicated on the structural drawings. Finish: galvanized coating complying with ASTM A 525 G60, or as indicated on the Structural Drawings.

2.03 ACCESSORIES

A. Furnish sheet metal closures for open ends of all cell raceways at columns, walls, and openings shown on Contract Drawings.

B. Provide sheet steel cover plates (or closure tape) as required to close panel and end conditions where panels change direction or abut.

C. Furnish material for column closures to close openings between panels and structural columns.

D. Provide welding hole cover, with friction fastening, to close welding access holes when required.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine the areas and conditions under which metal form decking items are to be installed. Notify the Architect and Owner’s Representative in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until satisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 ERECTION

A. Comply with recommended practices listed in the “SDI Manual of Construction with Steel Deck.”

B. The erection of the steel sub-floor shall be performed according to the manufacturer's standards and approved final shop drawings.

C. The design strength per weld shall comply with AISI specifications.

D. The steel sub-floor units shall be placed on the supporting steel framework and adjusted to final position before being permanently fastened. Each unit shall be brought to proper bearing on the supporting beams. If the supporting beams are not properly aligned or sufficiently level to permit proper bearing of the steel floor units, the steel floor contractor shall inform the Contractor. The steel floor units shall not to be placed until the necessary corrections are made. The floor units shall be placed in straight alignment for the entire length of run of flutes and with close registration of the flutes of one unit with those of abutting units, allowing a minimum of space between ends of abutting units.

3.03

A. Steel floor units shall be fastened to the steel framework at ends of units and at intermediate supports by welds no less than 3/4-inch diameter, spaced not more than 12 inches across width of floor unit. Where two units abut, each unit shall be fastened to the steel framing. Welds shall be free of sharp points or edges. Use weld washers for all metal thinner than 22 gauge.

B. The side laps of adjacent units shall be fastened between supports at intervals not exceeding 5 feet. Fasten side laps by welding at 36” o. c. maximum.

3.04 CUTTING AND DRILLING STEEL SUBFLOORS

A. Where large predetermined openings for stairs, elevators, ducts or other items occur, the steel subfloors shall be engineered by the manufacturer to fit these conditions as shown on the drawings. The reinforcing required for these openings shall be provided by the Contractor and shall comply with the Drawings.

B. Where holes or opening 6 inches in diameter and larger are required in subfloors, such holes shall be made by the respective trades requiring them and openings reinforced by these trades in compliance with the Drawings.

C. Holes smaller than 6 inches in diameter, required for passage of other work or attachment of the subfloors, shall be made by the respective trade involved. Reinforcement shall be in compliance with the Drawings.

D. Diagonal supports at columns, and any other miscellaneous supports required to carry the steel floor, shall be furnished and installed in accordance with the Drawings.

END OF SECTION

SECTION 05 3123
STEEL ROOF DECKING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General Conditions and other Division 1 Specification Sections, apply to the Work of this Section.

1.02 RELATED WORK

A. Structural Steel: Section 05120

B. Steel Joists: Section 05211

C. Section 05500, Metal Fabrication.

1.03 QUALITY ASSURANCE, CODES AND STANDARDS

A. Comply with the provisions of the following codes and standards, except as otherwise shown or specified.

1. Steel Deck Institute “SDI Manual of Construction with Steel Deck.”
2. “SDI Design Manual for Composite Decks, Form Decks and Roof Decks - No. 30."
3. AISI "Specification for the Design of Cold-Formed Steel Structural Members."
4. AWS "Specification for Welding Sheet Steel in Structures."
5. AISC "Specifications for Design of Light Gauge Cold-Formed Steel Structures. No. 30."
6. Job Site Safety: OSHA Regulation CFR 1926, Subparts M and R.

1.04 QUALIFICATION OF WELDING WORK

A. Qualify welding processes and welding operators in accordance with the AWS "Standard Qualification Procedure".

1.05 PERFORMANCE REQUIREMENTS

A. Compute the properties of metal roof deck sections on the basis of the effective design width as limited by the provisions of the AISI Specifications. Provide not less than the depth and gauges shown.

B. Uplift Loading: Install and anchor roof deck units to resist gross uplift loading of 20 pounds per square foot for roof areas.

1.06 SUBMITTALS

A. Submit manufacturer's specifications and installation instructions for each product specified. Include manufacturer's certification as may be required to show compliance with these specifications. Indicate by transmittal form that a copy of each instruction has been distributed to the Installer.

B. Submit detailed drawings showing layout of deck panels, anchorage details and every condition requiring closure panels, supplementary framing, special jointing or other accessories.

1.07 INSPECTION

A. Welding performed in conjunction with work in this Section is subject to inspection by the Owner's testing and inspection agency and as required by Prince George's County. The Owner will pay for all required testing. The Contractor shall be responsible for proper notification to the testing agency prior to performance of welding operations.

B. Decking welded in place is subject to inspection and testing. Expense of removing and replacing any portion of decking for testing purposes will be borne by the Owner if welds are found to be satisfactory.

Remove and replace work found to be defective and not complying with requirements. Expense of replacing defective work shall be borne by the Contractor.

1.08 DELIVERY AND STORAGE

A. Deliver and store deck bundles in a location on the project site that will allow proper and safe access by the hoisting equipment to the building structure.

B. Protect bundles from weather and damage. Store above ground and covered, with one end elevated. Use ventilated, waterproof coverings to avoid condensation on deck surface.

C. Deck bundles shall be stacked in a manner to avoid tipping, sliding or shifting while being stored.

D. Inspect bundles for tightness during storage. Provide additional securement if necessary.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Refer to Structural Drawings for type and gauge of roof deck.

B. Steel: ASTM A611 Grade C (painted deck) or ASTM A653, Grade A (galvanized deck).

C. Miscellaneous Steel Shapes: ASTM A-36.

D. Sheet Metal Accessories: ASTM A526, commercial quality, galvanized.

E. Galvanized zinc coating conforming to ASTM A924, G60.

F. Prime Paint: Manufacturer's baked-on, rust inhibitive paint, for application to chemically cleaned and phosphate chemical treated metal surfaces.

2.02 FABRICATION

A. General: Form deck units in lengths to span 3 or more support spacings, with flush, telescoped or nested 2" end laps and nesting side laps, unless otherwise shown or specified. Provide deck configurations complying with SDI Design Manual Specifications, and as specified herein.

B. Intermediate-Rib Deck: Prime painted, depth approximately 1 1/2"; ribs spaced approximately 6" o. c.; width of rib opening at roof surface not more than 1 3/4"; width of bottom rib surface not less than 1". Provide closures, anchor clips, sump pans for roof drains and all other necessary pieces for a complete installation.

C. Acoustical Wide Rib Deck: Prime painted, galvanized deck, depth approximately 1-1 1/2"; ribs spaced at 6" o. c.; width of rib opening at roof surface not more than 2-3/8"; width of bottom rib surface not less than 1-3/4". Webs of the ribs shall be perforated by 5/32" diameter holes staggered 3/8" o. c. The sound absorbing elements of glass fiber shall be furnished by the manufacturer for installation by the roofing contractor.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine the areas and conditions under which metal roof decking items and corrugated steel forms are to be installed. Notify the Architect and Owner’s Representative in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with recommended practices listed in the “SDI Manual of Construction with Steel Deck.”

B. Install roof deck units and accessories in accordance with manufacturer's recommendations, approved final shop drawings, and as specified.

C. Do not start placement of roof deck units before all supporting members are installed. Place roof deck units on supporting steel framework and adjust to final position with ends bearing on supporting members and accurately align end to end before being permanently fastened. Lap ends not less than 2". Do not stretch or contract the sidelap interlocks. Place deck units flat and square, secured to adjacent framing, without warp or excessive deflection.

D. Coordinate and cooperate with structural steel erector in positioning decking bundles to prevent overloading of structural members.

E. Do not use deck units for storage of working platforms until permanently secured in position.

F. Permanently fasten roof deck units to steel supporting members by not less than 1/2" diameter puddle welds, spaced 6" o. c. maximum at end laps and 12" o. c. maximum at intermediate supports. Secure deck to each supporting member where side laps occur. Side laps shall be welded at 36” o. c. maximum.

1. Use welding washers where gauge of decking is thinner than 22 gauge.

G. Comply with AWS requirements and procedures for manual shielded metal-arc welding, the appearance and quality of welds, and the methods used in correcting welding work.

H. Lock side laps between adjacent deck units at intervals as per manufacturer's instructions.

I. Cut and fit roof deck units and accessories around other work projecting through or adjacent to the roof decking. Provide neat, square, and trim cuts.

3.03 REINFORCEMENT AT OPENINGS

A. Provide additional metal reinforcement and closure pieces as required for strength and continuity of decking and support of other work. Refer to structural drawings for roof opening and equipment support. Unless noted otherwise, provide the following:

B. Openings less than 15” in any dimension: Reinforce roof decking around openings by means of a flat steel sheet placed over the opening and fusion welded to the top surface of the deck. Provide steel sheet of the same quality as the deck units, not less than nominal 0.0359" (20 gauge) thick before coating, and at least 12" wider and longer than the openings. Provide welds at each corner and spaced not more than 12" o. c. along each side.

C. For deck openings from 15" wide to 30" wide, and not supported by structural members: Weld a 1-1/2" x 1-1/2" x 3/16" steel angle to the underside of the roof deck at right angles to the roof deck ribs. Angle shall span joist to joist. Support the side parallel to the roof deck ribs with a 12" wide, 20 gauge steel sheet placed on the top surface of the decking, welded at each corner of the opening and at 12" o. c. along each side.

3.04 ROOF INSULATION SUPPORT

A. Provide metal closure strips for the support of roof insulation where the rib openings in the top surface of roof decking occur adjacent to edges and openings. Weld closure strips into position.

3.05 TOUCH-UP PAINTING

A. After roof decking installation, wire brush, clean and paint scarred areas, welds and rust spots on the top and bottom surfaces of decking units and supporting steel members. Touch-up shop galvanizing that is chipped or abraded or damaged with the same galvanized paint or as recommended by the deck manufacturer. Patch and close all holes in deck created by welding, prior to touch-up.

END OF SECTION

SECTION 05 4000
COLD FORMED METAL FRAMING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes, but is not limited to, the following.

1. Additional framing and furring as needed for standing seam installations..

B. Related Sections: The following sections contain requirements that relate to this Section:

1. Division 6 – Section 06100 Rough Carpentry
2. Division 7 – Section 07620 Sheet Metal Flashing and Trim

1.03 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each type of cold-formed metal framing, accessory, and product specified.

C. Welder certificates signed by Contractor certifying that welders comply with requirements Specified under the “Quality Assurance” Article.

D. Qualification data for firms and persons specified in the “Quality Assurance” Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed cold-formed metal framing installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Welding Standards: Comply with applicable provisions of AWSD1.1 “Structural Welding Code-

1. Certify that each welder has satisfactorily passed AWN qualification tests for welding processes involved and, if pertinent, has undergone recertification.

C. Fire-Test-Response Characteristics: Where fire-resistance-rated assemblies are indicated, provide cold-formed metal framing identical to that tested as part of an assembly for fire resistance per ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction. Fire-Resistance Ratings: As indicated by design designations listed in UL “Fire Resistance Directory” or by Warnock Hersey or another testing and inspecting agency acceptable to authorities having jurisdiction.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following.
   1. Consolidated Systems, Inc.
   2. Dale/Incor Industries of Florida
   3. Dale Industries, Inc.
   4. Dietrich Industries, Inc.
   5. Incor Plant Dale Industries
   6. Marino Ware; Div. of Ware Industries, Inc.
   7. Super Stud Building Products, Inc.
   8. Unimast, Inc.
   9. United States Steel

2.02 MATERIALS

A. Galvanized-Steel Sheet: ASTM A 446, zinc coated according to ASTM A 525, and as follows:
   1. Coating Designation: G60

B. Grade: As required by structural performance, but not lower than grade A, 33,000 PSI minimum yield strength, 20 percent elongation.

2.03 FRAMING

A. Steel Studs: Manufacturer’s standard C-shaped steel studs of web depths indicated, with lipped flanges and complying with the following:
   1. Design Uncoated-Steel Thickness: As indicated on drawings (20-gauge minimum at wall studs and track). No substitution of lighter gauges than that shown on drawings allowed.
   2. Flange Width: As indicated, but 1 5/8 inches minimum.
   3. Web: Punched.

B. Steel Track: Manufacturer’s standard U-shaped steel track, unpunched, of web depths indicated, with straight flanges, and complying with the following.
   1. Design Uncoated-Steel Thickness: As indicated on drawings (20 gauge minimum). Use thicker gauge as specified on drawings where track is welded to existing steel.
   2. Flange Width: Manufacturer’s standard deep flange where indicated, standard flange elsewhere.

2.04 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories of the same material and finish used for framing members, with a minimum yield strength of 33,000 psi.

B. Provide accessories of manufacturer’s standard thickness and configuration, unless otherwise indicated, as follows:
   1. Supplementary framing including furring channel (hat channel) and strapping.
   2. Bracing, bridging, and solid blocking.
   3. Gusset plates.
   4. Deflection track and vertical side clips.
   5. Stud kickers and girts.

6. Reinforcement plates.
7. Bridging U-Channels.
8. 2” x 2” galvanized steel angle (20ga.)

2.05 ANCHORS, CLIPS, AND FASTENERS

A. Steel shapes and Clips: ASTM A 36, zinc coated by the hot-dip process according to ASTM A 123.

B. Cast-in-Place Anchor Bolts and Studs: ASTM A 307, Grade; carbon-steel hex-head bolts and studs; carbon-steel nuts, and flat, unhardened-steel washers. Zinc coated by the hot-dip process according to ASTM A 153.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times the design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

D. Powder-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times the design load, as determined by testing per ASTME 1190 conducted by a qualified independent testing agency.

E. Mechanical Fasteners: Corrosion-resistant coated, self-drilling, self-threading steel drill screws. Head Type: Low-profile head beneath sheathing, manufacturer’s standard elsewhere.

F. Welding Electrodes: Comply with AWM standards.

2.06 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.

2.07 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, true to line, and with connections securely fastened, according to manufacturer’s recommendations and the requirements of this Section.

1. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire typing of framing members is not permitted.

a. Comply with AWS requirements and procedures for welding, appearance and quality of weld, and methods used in correcting welding work.

b. Locate mechanical fasteners and install according to cold-framed metal framing manufacturer’s instructions with screw penetrating joined members by not less than 3 exposed screw threads.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or distortion.

C. Fabrication Tolerances: Fabricate assemblies to a maximum allowable tolerance variation from plumb, level, and true to line of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements, including installation tolerances and other conditions affecting performance of cold-formed metal framing. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing and accessories plumb, square, true to line, and with connections securely fastened, according to manufacturer's recommendations and the requirements of this Section.

1. Cut framing members by sawing or shearing; do not torch cut.

2. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire typing of framing members is not permitted.

a. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work

b. Locate mechanical fasteners and install according to cold-framed metal framing manufacturer's instructions with screw penetrating joined members by not less than 3 exposed screw threads.

C. Install framing members in one-piece lengths, unless splice connections are indicated for track or tension members.

D. Provide temporary bracing and leave in place until framing is permanently stabilized.

E. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

F. Install insulation in built-up exterior framing members, such as headers, sills, boxed joists, and double studs, inaccessible upon completion of framing work.

G. Fasten reinforcement plate over web penetrations that exceed size of manufacturer's standard punched openings.

H. Erection Tolerances: Install cold-formed metal framing to a maximum allowable tolerance variation from plumb, level, and true to line of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requires of sheathing or other finishing materials.

3.03 ENTRANCE / BUS RIDER CANOPY SOFFIT AND FASCIA SUB FRAMING

A. Install steel framing components (Studs, track, hat channels) as needed in configurations required to support the installation of new aluminum flush-seam soffit panels and perimeter standing seam fascia panels. Attach framing members to the existing canopy's steel structural components. Install ¾" FRT plywood sheathing to the steel framing as required or as needed as a sub fascia. Install a peel and stick membrane over plywood before cladding with aluminum panels.

B. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

C. Squarely seat studs against webs of top and bottom tracks. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:

1. Stud Spacing: As indicated, but not greater than 16" inches on center.

D. Set studs plumb, except as needed for diagonal bracing or required for non plumb walls or warped surfaces and similar requirements.

E. Install miscellaneous framing and connections, including, clip angles, Attachment angles, anchors, fasteners, and stud girts, and diagonal and horizontal strapping, to provide a complete and stable framing system.

3.04 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanizing repair paint according to ASTMA A 780 and the manufacturer's instructions.

B. Touchup Painting: Wire brush, clean, and paint scarred areas, welds, and rust spots on fabricated and installed prime-painted, cold-formed metal framing.

1. Touchup painted surfaces with same type of shop paint used on adjacent surfaces.

C. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer to ensure that cold-formed metal framing is without damage or deterioration at the time of Substantial Completion.

END OF SECTION

SECTION 05 4400
COLD FORMED METAL TRUSSES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Cold-formed steel trusses for roofs.

1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold- formed steel trusses; fabrication; and fastening and anchorage details, including mechanical fasteners.

2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Delegated-Design Submittal: For cold-formed steel trusses.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Product test reports.

D. Field quality-control reports.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Product Tests: Mill certificates or data from a qualified testing agency, indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Aegis Metal Framing.

2. Genesis Worldwide Inc.

3. Marino/WARE.

4. Nuconsteel, A Nucor Company.

5. Steel Construction Systems.

6. TrusSteel; an ITW company.
7. USA Frametek.

2.02 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold- formed steel framing.

B. Structural Performance: Provide cold-formed steel trusses capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated.
2. Deflection Limits: Design trusses to withstand design loads without deflections greater than the following:
    a. Roof Trusses: Vertical deflection of 1/240 of the span.
3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).

C. Cold-Formed Steel Framing Design Standards:

1. Floor and Roof Systems: Design according to AISI S210.
2. Lateral Design: Design according to AISI S213.
3. Roof Trusses: Design according to AISI S214.

D. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.03 COLD-FORMED STEEL TRUSS MATERIALS

A. Steel Sheet: ASTM A 1003/A 1003M, structural grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: ST33H (ST230H).
2. Coating: G60 (Z180).

2.04 ROOF TRUSSES

A. Roof Truss Members: Manufacturer's standard C-shaped steel sections.

1. Connecting Flange Width: 1-5/8 inches (41 mm), minimum at top and bottom chords connecting to sheathing or other directly fastened construction.
2. Minimum Base-Metal Thickness: 0.0329 inch (0.84 mm).

2.05 ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, structural grade, Type H, metallic coated, of same grade and coating weight used for truss members.

B. Provide accessories of manufacturer's standard thickness and configuration unless otherwise indicated.

2.06 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and Appendix D in ACI 318, greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.

D. Power-Actuated Fasteners: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self- drilling, self-tapping steel drill screws.

1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.07 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B.

B. Shims: Load bearing, of high-density multimonomer plastic, nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.

2.08 FABRICATION

A. Fabricate cold-formed steel trusses and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate trusses using jigs or templates.
2. Cut truss members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel truss members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator.
    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
4. Fasten other materials to cold-formed steel trusses by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace trusses to withstand handling, delivery, and erection stresses. Lift fabricated trusses to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.01 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed steel trusses without reducing thickness of fire-resistive materials below that is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

3.02 INSTALLATION

A. Install, bridge, and brace cold-formed steel trusses according to AISI S200, AISI S214, AISI's "Code of Standard Practice for Cold- Formed Steel Structural Framing," and manufacturer's written instructions unless more stringent requirements are indicated.

B. Install cold-formed steel trusses and accessories plumb, square, and true to line, and with connections securely fastened.

1. Fasten cold-formed steel trusses by welding or mechanical fasteners.

a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

b. Locate mechanical fasteners and install according to Shop Drawings; comply with requirements for spacing, edge distances, and screw penetration.

C. Install temporary bracing and supports. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

D. Truss Spacing: 48 inches (1220 mm).

E. Do not alter, cut, or remove framing members or connections of trusses.

F. Erect trusses with plane of truss webs plumb and parallel to each other, align, and accurately position at spacings indicated.

G. Erect trusses without damaging framing members or connections.

H. Coordinate with wall framing to align webs of bottom chords and load- bearing studs or continuously reinforce track to transfer loads to structure. Anchor trusses securely at all bearing points.

I. Install continuous bridging and permanently brace trusses.

J. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Space individual trusses no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.03 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform inspections.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. Field and shop welds will be subject to testing and inspecting.

D. Prepare test and inspection reports.

3.04 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal trusses are without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 4500
METAL SUPPORT ASSEMBLIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Metal stud interior partition framing.
2. Suspended metal channel ceiling framing

B. Related Sections:

1. Section 01010 – General Conditions
2. Section 092900 – Gypsum Board

1.02 REFERENCES

A. ASTM International (ASTM):

1. A591/A591M - Standard Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Weight (Mass) Applications.
2. A641 - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
3. A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
4. A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.
5. C635 - Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
6. C636 - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
7. C645 - Standard Specification for Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board.
8. C754 - Standard Practice for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Wall board, Backing Board, or Water-Resistant Backing Board.
9. E90 - Standard Test Method for Airborne Sound Transmission Loss of Building Partitions.
10. E413 - Standard Test Method for Classification for Rating Sound Insulation.

B. Gypsum Association (GA) GA-600 - Fire Resistance Design Manual.

C. Steel Framing Industry Association (SFIA) (www.sfia.memberclicks.net) - Member Directory.

D. Steel Stud Manufacturer’s Association (SSMA)(www.ssma.com - Member Directory.

E. Underwriters Laboratories, Inc. (UL) - Fire Resistance Directory.

1.03 QUALITY ASSURANCE

A. Manufacturer: Current member of SSMA.

B. Installer Qualifications: Minimum 3 years experience in work of this Section.

C. Acoustic Ratings: Construct assemblies to achieve acoustic ratings indicated on Drawings, tested to ASTM E90 and classified in accordance with ASTM E413.

D. Deflection Limits:

1. Limit deflection of partitions to following limits, based on 5 PSF uniform design load.
    a. Partitions: L/120.
    b. If partition height exceeds stud manufacturer's limiting height for applicable loading and deflection, install bracing above ceiling, decrease stud spacing, or increase stud gage.
2. Limit deflection of ceilings to L/360.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
    1. ClarkDietrich, www.clarkdietrich.com.
    2. Marino/WARE, www.marinoware.com.
    3. Safeco Steel Framing Products, www.safeco.com.
    4. Studco Building Systems, www.studcosystems.com.
    5. Substitutions: Under provisions of Section 01010 – General Conditions.

2.02 MATERIALS

A. Steel: ASTM A653/A653M or ASTM A1003/1003M, Class G40 hot dip galvanized.

2.03 COMPONENTS

A. Provide components in accordance with ASTM C645.
B. Studs: Non-load bearing roll-formed steel, SSMA stud profile, C-shaped, punched for utility access.
C. Top and Bottom Tracks:
    1. Same material and finish as studs, C-shaped.
    2. Standard track: SSMA stud track profile, 1-1/4 inch legs.
D. Suspended Ceiling Grid:
    1. Match existing.

2.04 ACCESSORIES

A. Fasteners: 3/8 inch long pan head screws.

PART 3 - EXECUTION

3.01 INSTALLATION OF PARTITION FRAMING

A. Install in accordance with ASTM C754 and manufacturer's instructions.
B. Attach top and bottom tracks at ends and 24 inches on center maximum.
C. Position studs vertically in tracks, spaced maximum 16 inches on center unless indicated otherwise.
D. Locate studs maximum 1/2 inch from door frames and abutting construction.
E. Use heavier gage studs or double studs on both sides of openings in partitions.
F. Install horizontal track as header above openings in partitions. Install studs from header to top track.
G. Provide wood or metal bracing in partitions to receive and support fixtures, trim, accessories and other applied items.
H. Brace ceiling height partitions to structure at 48 inches on center maximum.

3.02 INSTALLATION OF CEILING GRID

A. Install in accordance with ASTM C636 and manufacturer's instructions.

B. Patch existing grid where light fixtures are being removed but removing cross tees and replacing them with full length ones.

END OF SECTION

SECTION 05 5000
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel and aluminum items.

B. Prefabricated ladders and ship ladders.

C. Ladder safety systems.

D. Downspout boots.

E. Cast iron tree gates.

F. Cast iron trench castings.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.

B. Section 03 3800 - Post-Tensioned Concrete: Placement of metal fabrications in post-tensioned concrete.

C. Section 03 4100 - Precast Structural Concrete: Placement of metal fabrication in precast structural concrete.

D. Section 03 4500 - Precast Architectural Concrete: Placement of metal fabrication in precast architectural concrete.

E. Section 04 2000 - Unit Masonry: Placement of metal fabrications in masonry.

F. Section 04 2001 - Masonry Veneer: Placement of metal fabrications in masonry.

G. Section 04 2600 - Single-Wythe Unit Masonry: Placement of metal fabrications in masonry.

H. Section 04 2616 - Adhered Masonry Veneer: Placement of metal fabrications in masonry.

I. Section 04 2723 - Cavity Wall Unit Masonry: Placement of metal fabrications in masonry.

J. Section 04 2900 - Engineered Unit Masonry: Placement of metal fabrications in masonry.

K. Section 05 1200 - Structural Steel Framing: Structural steel column anchor bolts.

L. Section 05 2100 - Steel Joist Framing: Structural joist bearing plates, including anchorage.

M. Section 05 3100 - Steel Decking: Bearing plates for metal deck bearing, including anchorage.

N. Section 05 5100 - Metal Stairs.

O. Section 05 5213 - Pipe and Tube Railings.

P. Section 07 7123 - Manufactured Gutters and Downspouts: Downspout boots.

Q. Section 09 9113 - Exterior Painting: Paint finish.

R. Section 09 9123 - Interior Painting: Paint finish.

S. Section 32 3300 - Site Furnishings: Steel pipe bollards to match other site furnishings.

1.03 REFERENCE STANDARDS

A. 29 CFR 1910.23 - Ladders current edition.

B. 29 CFR 1910.28 - Duty to have Fall Protection and Falling Object Protection Current Edition.

C. 29 CFR 1910.29 - Fall Protection Systems and Falling Object Protection - Criteria and Practices Current Edition.

D. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2014 (2015 Errata).

E. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.

F. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.

G. ALI A14.3 - Ladders - Fixed - Safety Requirements 2014.

H. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements 2008.

I. ANSI/ASSP Z359.0 - Definitions and Nomenclature Used for Fall Protection and Fall Arrest 2012.

J. ANSI/ASSP Z359.11 - Safety Requirements for Full Body Harnesses 2014.

K. ANSI/ASSP Z359.12 - Connecting Components for Personal Fall Arrest Systems 2009.

L. ANSI/ASSP Z359.15 - Safety Requirements for Single Anchor Lifelines and Fall Arresters for Personal Fall Arrest Systems 2014.

M. ANSI/ASSP Z359.16 - Safety Requirements for Climbing Ladder Fall Arrest Systems 2016.

N. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.

O. ASTM A48/A48M - Standard Specification for Gray Iron Castings 2003 (Reapproved 2016).

P. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2018.

Q. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

R. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

S. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications 2016.

T. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates 2013.

U. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2014 (Editorial 2017).

V. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2013.

W. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2014.

X. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2017.

Y. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.

Z. ASTM B85/85M - Standard Specification for Aluminum-Alloy Die Castings 2014.

AA. ASTM B177/B177M - Standard Guide for Engineering Chromium Electroplating 2011 (Reapproved 2017).

BB. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.

CC. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.

DD. ASTM B210 - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes 2012.

EE. ASTM B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes (Metric) 2012.

FF. ASTM B211 - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire 2012.

GG. ASTM B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold-Finished Bar, Rod, and Wire (Metric) 2012.

HH. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2014.

II. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2013.

JJ. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2015.

KK. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2012.

LL. AWS D1.1/D1.1M - Structural Welding Code - Steel 2015, with Errata (2016).

MM. AWS D1.2/D1.2M - Structural Welding Code - Aluminum 2014, with Errata.

NN. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel 2017.

OO. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 1999 (Ed. 2004).

PP. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic") 2002 (Ed. 2004).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data sheets on each ladder safety system product to be used, including installation instructions.

C. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

2. Design data: Submit drawings and supporting calculations, signed and sealed by a qualified professional structural engineer.

a. Include the following, as applicable:

1) Design criteria.

2) Engineering analysis depicting stresses and deflections.

3) Member sizes and gages.

4) Details of connections.

5) Support reactions.

6) Bracing requirements.

D. Certificate: Provide documentation that ladder safety system products of this section meet or exceed cited 29 CFR 1910.28, 29 CFR 1910.29, ANSI/ASSP Z359.16 and ANSI A14.3 requirements.

E. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

F. Designer's Qualification Statement.

G. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.05 QUALITY ASSURANCE

A. Design [_____] under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in Maryland.

B. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

C. Plates: ASTM A283/A283M.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

E. Slotted Channel Framing: ASTM A653/A653M, Grade 33.

F. Slotted Channel Fittings: ASTM A1011/A1011M.

G. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.

H. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

I. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

J. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 MATERIALS - ALUMINUM

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

B. Sheet Aluminum: ASTM B209 (ASTM B209M), 5052 alloy, H32 or H22 temper.

C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210 (ASTM B210M), 6063 alloy , T6 temper.

D. Aluminum-Alloy Bars: ASTM B211 (ASTM B211M), 6061 alloy , T6 temper.

E. Aluminum-Alloy Die Castings: ASTM B85/B85M.

F. Bolts, Nuts, and Washers: Stainless steel.

G. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.03 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.04 FABRICATED ITEMS

A. Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; prime paint finish.

1. Side Rails: 3/8 x 2 inches (9 x 50 mm) members spaced at 20 inches (500 mm).
2. Rungs: one inch (25 mm) diameter solid round bar spaced 12 inches (300 mm) on center.
3. Space rungs 7 inches (175 mm) from wall surface.

B. Telescopic Steel Columns: Steel pipe; prime paint finish.

1. Diameter: 3 inch (75 mm).
2. Height: 6 to 9 feet (1.83 to 2.75 m).

C. Bumper Posts and Guard Rails: As detailed; prime paint finish.

D. Joist Hangers: Strap anchors, fabricated with sheet steel, 18 gage, 0.0478 inch (1.21 mm) minimum base metal thickness; galvanized finish.

E. Ledge Angles, Shelf Angles, Channels and Plates Not Attached to Structural Framing: For support of metal decking; prime paint finish.

F. Lintels: As detailed; prime paint finish.

G. Sill Angles for Tempered Glass Railing Assemblies: ASTM A36/A36M steel angles with anchoring devices and sizes as indicated in shop drawings for railing assembly, drilled and tapped for fastener types, sizes, and spacing indicated, prime paint finish.

H. Door Frames for Overhead Door Openings, Wall Openings and [_____]: Channel sections; prime paint finish.

I. Recessed Mat Frames : As detailed; steel, galvanized finish.

J. Foot Scrapers, Mud and Foot Grilles and Pans: As detailed; aluminum, mill finish.

K. Elevator Hoistway Divider Beams: Beam sections; prime paint finish.

L. Toilet Partition Suspension Members: Steel channel sections; prime paint finish.

M. Slotted Channel Framing: Fabricate channels and fittings from structural steel complying with the referenced standards; factory-applied, rust-inhibiting thermoset acrylic enamel finish.

2.05 PREFABRICATED LADDERS

A. Prefabricated Ladder: Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.

1. Components: Manufacturer's standard rails, rungs, treads, handrails. returns, platforms and safety devices complying with the requirements of the MATERIALS article of this section.
2. Materials: Aluminum; ASTM B221 ASTM B221M 6063 alloy, T52 temper.
3. Finish: Powder coat; color to be selected by Architect from manufacturer's standard range.
4. Manufacturers:
    a. Industrial Ladder & Scaffolding, Inc.; [_____]: www.anyladder.com/#sle.
    b. O'Keeffe's Inc; Model 500: www.okeeffes.com/#sle.
    c. Substitutions: See Section 01 6000 - Product Requirements.

B. Prefabricated Ship Ladder: Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.

1. Components: Manufacturer's standard rails, rungs, treads, handrails. returns, platforms and safety devices complying with the requirements of the MATERIALS article of this section.
2. Materials: Aluminum; ASTM B221 (ASTM B221M), 6063 alloy, T52 temper.
3. Incline: 60 degrees.
4. Finish: Powder coat; color to be selected by Architect from manufacturer's standard range.
5. Manufacturers:
    a. O'Keeffe's Inc; Model 520: www.okeeffes.com/#sle.
    b. Substitutions: See Section 01 6000 - Product Requirements.

2.06 LADDER SAFETY SYSTEMS

A. Climbing Ladder Fall Arrest System (CLAFS): Comply with 29 CFR 1910.29, 29 CFR 1926.1053, Section 7 of ALI A14.3 and ANSI/ASSP Z359.16; climbing ladder fall arrest system allows worker to climb up and down using both hands; does not require employee continuously, hold, push, or pull any part of system while climbing.
    1. Install on new fixed ladders over 24 feet (7315 mm) in height.
    2. Anchorage: Fixed ladder meeting requirements of 29 CFR 1910.23.
    3. Rigid Carrier: Fixed 304 stainless steel U-shaped slotted track with top, bottom and intermediate supports; meeting requirements of ANSI/ASSP Z359.16.
    4. Fall Arrester: Stainless steel and aluminum automatic pass-through carrier sleeve fall arrester meeting requirements of ANSI/ASSP Z359.15 and ANSI/ASSP Z359.16; compatible with carrier.
    5. Manufacturers; ANSI/ASSP Z359.16 compliant:
        a. 3M Personal Safety Division; [_____]: www.3M.com/FallProtection/#sle.
        b. MSA Safety Incorporated; [_____]: www.msasafety.com/#sle.
        c. Substitutions: See Section 01 6000 - Product Requirements.

B. Ladder Safety System: Comply with 29 CFR 1910.29, 29 CFR 1926.1053 and Section 7 of ALI A14.3; ladder safety system allows the worker to climb up and down using both hands; does not require the employee continuously, hold, push, or pull any part of the system while climbing.
    1. Install on new fixed ladders over 24 feet (7315 mm) in height.
    2. Anchorage: Fixed ladder meeting requirements of 29 CFR 1910.23.
    3. Rigid Carrier: Fixed 304 stainless steel U-shaped slotted track with top, bottom and intermediate supports.
    4. Fall Arrester: Stainless steel automatic pass-through carrier sleeve fall arrester; compatible with carrier.

C. Personal Fall Arrest System Components; 29 CFR 1910.140:
    1. Body Support: Full body harness meeting requirements of ANSI/ASSP Z359.11; equipped with front or hip D-rings for attachment to climbing ladder fall arrest system.
    2. Connecting Means: Connecting hardware, such as a locking carabiner, meeting requirements of ANSI/ASSP Z359.12; compatible with fall arrester and body support harness.

2.07 DOWNSPOUT BOOTS

A. Downspout Boots: Smooth interior without boxed corners or choke points; include integral lug slots, integral cleanout, cleanout cover and tamper proof fasteners.

1. Configuration: Angular.
2. Material: Cast iron; ASTM A48/A48M; casting thickness 3/8 inch (9.5 mm), minimum.
3. Finish: Manufacturer's standard factory applied powder coat finish.
4. Color: To be selected by Architect from manufacturer's standard range.
5. Accessories: Manufacturer's standard stainless steel fasteners, stainless steel building wall anchors, integral neoprene gaskets and rubber coupling.
6. Manufacturers:
    a. Downspoutboots.com, a division of J. R. Hoe & Sons; [____]: www.downspoutboots.com/#sle.
    b. Substitutions: See Section 01 6000 - Product Requirements.

2.08 CAST IRON TREE GRATES

A. Cast Iron Tree Grates:
1. Material: Cast iron; ASTM A48/A48M.
2. Manufacturers:
    a. Neenah Foundry, a division of Neenah Enterprises, Inc: www.nfco.com/#sle.
    b. Substitutions: See Section 01 6000 - Product Requirements.

2.09 CAST IRON TRENCH CASTINGS

A. Cast Iron Trench Castings:
1. Material: Cast iron; ASTM A48/A48M, Class 35 B (heavy duty).
2. Grate Type: Manufacturer's standard Type A.
3. Manufacturers:
    a. Neenah Foundry, a division of Neenah Enterprises, Inc: www.nfco.com/#sle.
    b. Substitutions: See Section 01 6000 - Product Requirements.

2.10 FINISHES - STEEL

A. Prime paint steel items.
1. Exceptions: Galvanize .
2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.

B. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

C. Prime Painting: One coat.

D. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating. (Provide minimum 530 g/sq m galvanized coating.)

E. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.11 FINISHES - ALUMINUM

A. Exterior Aluminum Surfaces: Class I color anodized.

B. Interior Aluminum Surfaces: Class I natural anodized.

C. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.

D. Class II Natural Anodized Finish: AAMA 611 AA-M12C22A31 Clear anodic coating not less than 0.4 mils (0.01 mm) thick.

E. Class I Color Anodized Finish: AAMA 611 AA-M12C22A44 Electrolytically deposited colored anodic coating not less than 0.7 mils (0.018 mm) thick; light bronze.

F. Class II Color Anodized Finish: AAMA 611 AA-M12C22A34 Electrolytically deposited colored anodic coating not less than 0.4 mils (0.01 mm) thick; light bronze.

G. High Performance Organic Coating System: AAMA 2604 multiple coat, thermally cured fluoropolymer system; color as indicated.

1. Manufacturers:

a. Sherwin-Williams Company; POLANE Solar Reflective 2K Urethane Enamel: oem.sherwin-williams.com/#sle.

b. Substitutions: See Section 01 6000 - Product Requirements.

H. Superior Performance Organic Coating System: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride system; color as indicated.

1. Manufacturers:

a. Valspar; Fluropon: www.valsparcoilextrusion.com/#sle.

b. Substitutions: See Section 01 6000 - Product Requirements.

2.12 FABRICATION TOLERANCES

A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).

C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).

D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).

E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Confirm that the ladder structure to which the ladder safety system is installed is capable of withstanding the loads applied by the system in the event of a fall.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Install ladder safety system in accordance with manufacturer's instructions.

C. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

D. Field weld components as indicated on drawings.

E. Perform field welding in accordance with AWS D1.1/D1.1M.

F. Obtain approval prior to site cutting or making adjustments not scheduled.

G. After erection, prime welds, abrasions, and surfaces not shop primed , except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

C. Maximum Out-of-Position: 1/4 inch (6 mm).

END OF SECTION

SECTION 05 5100
METAL STAIRS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Stairs with concrete treads.

B. Stairs with metal treads.

C. Stairs with grating treads.

D. Prefabricated stairs.

E. Structural steel stair framing and supports.

F. Handrails and guards.

G. Prefabricated stair treads and nosings.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete fill in stair pans; mesh reinforcement for landings.

B. Section 03 3000 - Cast-in-Place Concrete: Placement of metal anchors in concrete.

C. Section 04 2000 - Unit Masonry: Placement of metal fabrications in masonry.

D. Section 04 2600 - Single-Wythe Unit Masonry: Placement of metal fabrications in masonry.

E. Section 04 2616 - Adhered Masonry Veneer: Placement of metal fabrications in masonry.

F. Section 04 2723 - Cavity Wall Unit Masonry: Placement of metal fabrications in masonry.

G. Section 04 2900 - Engineered Unit Masonry: Placement of metal fabrications in masonry.

H. Section 05 5000 - Metal Fabrications.

I. Section 05 5213 - Pipe and Tube Railings: Metal handrails and balusters other than specified in this section.

J. Section 06 2000 - Finish Carpentry: Wood handrails.

K. Section 09 9113 - Exterior Painting: Paint finish.

L. Section 09 9123 - Interior Painting: Paint finish.

M. Section 10 1400 - Signage: Photoluminescent markings.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

B. AISC 201 - AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures 2006.

C. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling 2017.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

F. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2014 (Editorial 2017).

G. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2014.

H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2017.

I. ASTM A786/A786M - Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates 2015.

J. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable 2018.

K. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.

L. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2014.

M. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2013.

N. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings 2013, with Editorial Revision.

O. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings 2000 (Reapproved 2006).

P. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions 2015a.

Q. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2012.

R. AWS D1.1/D1.1M - Structural Welding Code - Steel 2015, with Errata (2016).

S. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel 2017.

T. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

U. NAAMM AMP 510 - Metal Stairs Manual 1992.

V. NAAMM MBG 531 - Metal Bar Grating Manual 2017.

W. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 1999 (Ed. 2004).

X. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic") 2002 (Ed. 2004).

Y. SSPC-SP 2 - Hand Tool Cleaning 1982, with Editorial Revision (2004).

Z. UL 1994 - Luminous Egress Path Marking Systems Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide .

C. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

2. Include the design engineer's seal and signature on each sheet of shop drawings.

D. Design Data: As required by authorities having jurisdiction.

E. Welders' Certificates.

F. Designer's Qualification Statement.

G. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is certified under AISC 201.

H. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.05 QUALITY ASSURANCE

A. Welder Qualifications: Show certification of welders employed on the Work, verifying AWS qualification within the previous 12 months.

B. Fabricator Qualifications:

1. A qualified steel fabricator that is certified by the American Institute for Steel Construction (AISC) under AISC 201.

2. A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Custom Metal Stair Fabricators:

1. Substitutions: See Section 01 6000 - Product Requirements.

B. Prefabricated Metal Stairs:

1. Lapeyre Stair, Inc: www.lapeyrestair.com/#sle.

2. Pacific Stair Corporation: www.pacificstair.com/#sle.

3. Substitutions: See Section 01 6000 - Product Requirements.

C. Unit Stair Towers:

1. Alfab, Inc: www.alfabinc.com/#sle.

2. American Stair, Inc: www.americanstair.com/#sle.

3. Pacific Stair Corporation: www.pacificstair.com/#sle.

4. Substitutions: See Section 01 6000 - Product Requirements.

D. Factory Fabricated Stair Treads and Nosings:

1. Nystrom, Inc: www.nystrom.com/#sle.

2. Ross Technology Corporation: www.rosstechnology.com/#sle.

3. Wooster Products, Inc; Alumogrit Type 101: www.woosterproducts.com/#sle.

4. Substitutions: See Section 01 6000 - Product Requirements.

E. Photoluminescent Stair Treads, Nosings, and Accessories:

1. Ecoglo, Inc: www.us.ecoglo.com/#sle.

2. Nystrom, Inc; Safe-T-Lume Two-Part Abrasive Nosing, Photoluminescent Grit: www.nystrom.com/#sle.

3. Safe-T-Nose, LLC: www.safetnose.com/#sle.
4. Wooster Products, Inc; Niteglow M231BF-NG: www.woosterproducts.com/#sle.
5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 METAL STAIRS - GENERAL

A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.

1. Regulatory Requirements: Provide stairs and railings complying with the most stringent requirements of local, state, and federal regulations; where requirements of the contract documents exceed those of regulations, comply with the contract documents.
2. Handrails: Comply with applicable accessibility requirements of ADA Standards.
3. At exit stairwells, provide unit stair towers designed for stacking to height of building as a self-supporting structure.
4. Photoluminescent Stair Accessories: Comply with applicable building code.
5. Dimensions: As indicated on drawings.
6. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
7. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
8. Separate dissimilar metals using paint or permanent tape.

B. Metal Jointing and Finish Quality Levels:

1. Architectural: All joints as inconspicuous as possible, whether welded or mechanical.
    a. Welded Joints: Continuously welded and ground smooth and flush.
    b. Mechanical Joints: Butted tight, flush, and hairline; concealed fastenings only.
    c. Exposed Edges and Corners: Eased to small uniform radius.
    d. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for highest quality gloss finish.
2. Commercial: Exposed joints as inconspicuous as possible, whether welded or mechanical; underside of stair not covered by soffit IS considered exposed to view.
    a. Welded Joints: Intermittently welded on back side, filled with body putty, and sanded smooth and flush.
    b. Welds Exposed to View: Ground smooth and flush.
    c. Mechanical Joints: Butted tight, flush, and hairline.
    d. Bolts Exposed to View: Countersunk flat or oval head bolts; no exposed nuts.
    e. Exposed Edges and Corners: Eased to small uniform radius.
    f. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for satin or matte finish.
3. Service: Exposed joints tight with face surfaces aligned; underside of stair not covered by soffit is not considered exposed to view.
    a. Welded Joints: Welded on back side wherever possible.
    b. Welds Exposed to View: Ground smooth; not required to be flush.

c. Bolts Exposed to View: Countersunk flat or oval head bolts; no exposed nuts or screw threads.

d. Metal Surfaces to be Painted: Sanded smooth, suitable for satin or matte finish.

4. Industrial: All joints made neatly.

a. Welded Joints: Welded on back side wherever possible.

b. Welds Exposed to Touch: Ground smooth.

c. Bolts Exposed to Touch in Travel Area: No nuts or screw threads exposed to touch.

C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.03 METAL STAIRS WITH CONCRETE TREADS

A. Jointing and Finish Quality Level: Architectural, as defined above.

B. Risers: Closed.

C. Treads: Metal pan with field-installed concrete fill.

1. Concrete Depth: 1-1/2 inches (38 mm), minimum.

2. Precast Concrete Treads:

a. Concrete Strength: 5,000 psi (35 MPa) at 28 days, minimum.

b. Air Content: 4 to 6 percent.

c. Cement Color: Natural gray.

d. Aggregate Color: As required to make finished product match Architect 's sample.

e. Abrasive Strip: Contrasting color, embedded into surface 1/2 inch (12 mm) back of point of nosing.

f. Anchorage to Tread Pan: Epoxy adhesive.

3. Tread Pan Material: Steel sheet.

4. Tread Pan Thickness: As required by design; 14 gage, 0.075 inch (1.9 mm) minimum.

5. Photoluminescent Nosing: Factory fabricated aluminum nosing with embedded photoluminescent strip; cast into front edge of tread.

6. Factory Fabricated Tread and Nosing: Manufacturer's standard, field applied aluminum walking surface with integral nosing, abrasive filler and factory applied finishes.

7. Pan Anchorage to Stringers: Welded or bolted to carrier angles welded or bolted to stringers.

8. Concrete Reinforcement: None.

9. Concrete Finish: For resilient floor covering.

D. Risers: Same material and thickness as tread pans.

1. Riser/Nosing Profile: Sloped riser with rounded nosing of minimum radius.

2. Riser/Nosing Profile: Vertical riser with underside of nosing sloped up from bottom of tread pan at not less than 60 degrees from horizontal, with rounded top of nosing of minimum radius.

3. Nosing Depth: Not more than 1-1/2 inch (38 mm) overhang.

4. Nosing Return: Flush with top of concrete fill, not more than 1/2 inch (12 mm) wide.

E. Stringers: Rolled steel channels.
   1. Stringer Depth: 10 inches (250 mm).
   2. End Closure: Sheet steel of same thickness as risers welded across ends.
F. Landings: Similar construction, using corrugated steel decking, supported and reinforced as required to achieve design load capacity.
G. Railings: Steel pipe railings.
H. Photoluminescent Handrail Strips: Factory fabricated, field applied strips.
I. Finish: Galvanized after fabrication, except sheet components to be galvanized before fabrication.
J. Under Side of Stair: Exposed to view, to be finished same as specified for other exposed to view surfaces.

2.04 METAL STAIRS WITH METAL TREADS

A. Jointing and Finish Quality Level: Service, as defined above.
B. Risers: Open.
C. Treads: Checkered steel plate.
   1. Tread Thickness: 1/4 inch (6 mm), minimum.
   2. Nosing: Plate bent to minimum radius with down return of 1 inch (25 mm).
   3. Photoluminescent Nosing: Factory fabricated aluminum nosing with embedded photoluminescent strip; field applied to front edge of tread.
   4. Factory Fabricated Tread and Nosing: Manufacturer's standard, with integral tread, nosing, abrasive filler and factory applied finishes.
   5. Anchorage to Stringers: Welded or bolted to carrier angles welded or bolted to stringers.
D. Risers: Steel sheet.
   1. Riser Thickness: As required by design; 14 gage, 0.075 inch (1.9 mm) minimum.
   2. Riser/Nosing Profile: Sloped riser with rounded nosing of minimum radius.
E. Stringers: Rolled steel channels.
   1. Stringer Depth: 10 inches (250 mm).
   2. End Closure: Sheet steel of same thickness as risers welded across ends.
F. Landings: Same construction as treads, supported and reinforced as required to achieve design load capacity.
G. Railings: Steel pipe railings.
H. Photoluminescent Handrail Strips: Factory fabricated, field applied strips.
I. Finish: Galvanized after fabrication, except sheet components are to be galvanized before fabrication.

2.05 METAL STAIRS WITH GRATING TREADS

A. Jointing and Finish Quality Level: Industrial, as defined above.
B. Risers: Closed.
C. Treads: Steel bar grating.
   1. Grating Type: Welded.

2. Bearing Bar Depth: 3/4 inch (19 mm), minimum.
3. Top Surface: Standard.
4. Nosing: Checkered plate.
5. Nosing Width: 1-1/4 inch (32 mm), minimum.
6. Photoluminescent Nosing: Factory fabricated aluminum nosing with embedded photoluminescent strip; field applied to front edge of tread.
7. Factory Fabricated Tread and Nosing: Manufacturer's standard, with integral tread, nosing, abrasive filler and factory applied finishes.
8. Anchorage to Stringers: End plates welded to grating, bolted to stringers.

D. Stringers: Rolled steel channels.
1. Stringer Depth: 10 inches (250 mm).
2. End Closure: Sheet steel of same thickness as risers welded across ends.

E. Landings: Same construction as treads, supported and reinforced as required to achieve design load capacity.

F. Railings: Steel pipe railings.

G. Photoluminescent Handrail Strips: Factory fabricated, field applied strips.

H. Finish: Galvanized after fabrication.

2.06 PREFABRICATED STAIRS

A. Prefabricated Egress Stairs: Welded steel unit, factory fabricated to greatest degree practical and in the largest components possible.
1. Design Requirements: Comply with structural design criteria stated elsewhere in this section, the applicable requirements of ASTM E985.
a. Comply with ADA Standards.
b. Comply with applicable sections of the IBC.
2. Materials: Manufacturer's standard steel tubes, plates, bars, shapes, sheets, wire and mesh complying with the requirements of the MATERIALS article of this section.
a. Rails: Manufacturer's standard rails.
1) Guardrails: 42 inches (1067 mm) high.
2) Handrails: 30 inches (762 mm) to 38 inches (965 mm) high.
3) Infill: Manufacturer's standard pickets.
b. Treads: Manufacturer's standard concrete pan.
c. Finish: Red oxide primer; manufacturer's standard.
3. Manufacturers:
a. Lapeyre Stair, Inc; 10AA: www.lapeyrestair.com/#sle.
b. Substitutions: See Section 01 6000 - Product Requirements.

B. Modular Egress and Access Stairs: Standardized, modular stair components designed with manufacturer's standard stair angle and height charts; to be field assembled with mechanical fasteners only.

1. Design Requirements: Comply with structural design criteria stated elsewhere in this section and the applicable requirements of ASTM E985.
    a. Comply with ADA Standards.
    b. Comply with applicable sections of the IBC.
2. Materials: Manufacturer's standard steel tubes, plates, bars, shapes, sheets, wire and mesh complying with the requirements of the MATERIALS article of this section.
    a. Rails: Manufacturer's standard rails.
        1) Guardrails: 48 inches (1067 mm) high.
        2) Handrails: 30 inches (762 mm) to 38 inches (965 mm) high.
        3) Infill: Manufacturer's standard pickets.
    b. Treads: Manufacturer's standard concrete pan.
    c. Finish: Manufacturer's standard hot-dipped galvanizing; comply with ASTM A153/A153M.
3. Assembly Option: Shipped unassembled.
4. Manufacturers:
    a. Lapeyre Stair, Inc; 03/04: www.lapeyrestair.com/#sle.
    b. Pacific Stair Corporation: www.pacificstair.com/#sle.
    c. Substitutions: See Section 01 6000 - Product Requirements.

C. Alternating Tread Stairs: Welded metal unit; factory fabricated to the greatest degree possible.
1. Design Requirements:
    a. Stair Load Capacity: Support the following without exceeding the allowable working stress of the material.
        1) Single Point Load: 1000 pounds (4448 N).
        2) Distributed Load: 100 pounds per square foot (4788 Pa).
    b. Guardrail and Handrail Capacity: Support the following without exceeding the allowable working stress of the material.
        1) Single Point Load: 200 pounds (890 N).
        2) Distributed Load: 50 pounds per linear foot (8760 N/m).
    c. Support the following without exceeding the allowable working stress of the material.
        1) Single Point Load: 1000 pounds (4448 N).
        2) Distributed Load: 100 pounds per square foot (4788 Pa).
2. Materials: Aluminum; ASTM B221 ASTM B221M 6063 alloy, T52 temper.
    a. Stair Angle: As determined by architect.
    b. Components: Manufacturer's standard handrails, guardrails, non-skid treads and stringers.
    c. Finish: Natural aluminum.
    d. Accessories: Manufacturer's standard foot divider with rubber bumper strip.
3. Manufacturers:
    a. Lapeyre Stair, Inc; Alternating Tread Stair: www.lapeyrestair.com/#sle.

b. Substitutions: See Section 01 6000 - Product Requirements.

2.07 HANDRAILS AND GUARDS

A. Wall-Mounted Rails: As specified in Section 05 5213.

B. Guards: Pipe railings as specified in Section 05 5213.

C. Photoluminescent Handrail Strips: Factory fabricated, field applied strips.

2.08 ACCESSORIES

A. Photoluminescent Nosing: Factory fabricated aluminum extrusion with replaceable embedded photoluminescent and slip-resistant strip, complies with UL 1994.

1. Finish: Manufacturer's standard clear anodized.
2. Color: To be selected by Architect from manufacturer's standard range.
3. Attachment: Provide manufacturer approved field applied adhesive and mechanical fasteners.
4. Manufacturers:
   a. Safe-T-Nose, LLC: www.safetnose.com/#sle.
   b. Substitutions: See Section 01 6000 - Product Requirements.

B. Factory Fabricated Stair Tread and Nosing:

1. Materials: Cast Aluminum.
   a. Tread Abrasive: Cross-hatched silicon carbide abrasive 20 grit.
   b. Finish: Natural sand cast finish.
2. Manufacturers:
   a. Nystrom, Inc: www.nystrom.com/#sle.
   b. Substitutions: See Section 01 6000 - Product Requirements.

C. Photoluminescent Handrail Strips: Manufacturer's standard clear anodized aluminum extrusion with embedded photoluminescent strip, complies with UL 1994.

1. Attachment: Provide manufacturer approved field applied adhesive, factory applied adhesive and mechanical fasteners.
2. Manufacturers:
   a. Safe-T-Nose, LLC: www.safetnose.com/#sle.
   b. Substitutions: See Section 01 6000 - Product Requirements.

D. Steel Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.

E. Steel Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.

F. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

H. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.09 SHOP FINISHING

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Do not prime surfaces in direct contact with concrete or where field welding is required.

C. Prime Painting: Use specified shop- and touch-up primer.

1. Preparation of Steel: In accordance with SSPC-SP 2 Hand Tool Cleaning.

2. Number of Coats: One.

D. Galvanizing: Hot-dip galvanize to minimum requirements of ASTM A123/A123M.

1. Touch up abraded areas after fabrication using specified touch-up primer for galvanized surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

3.03 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Provide welded field joints where specifically indicated on drawings. Perform field welding in accordance with AWS D1.1/D1.1M.

D. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.

E. Obtain approval prior to site cutting or creating adjustments not scheduled.

F. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

3.05 SCHEDULES

A. Stairs A and B: Concrete-filled pan treads and landings, primed finish.

B. Stair C: Checkered plate treads and landings, galvanized finish. Pipe handrails as specified in Section 05 5213.

END OF SECTION

SECTION 05 5213
PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall mounted handrails.

B. Stair railings and guardrails.

C. Free-standing railings at steps.

D. Balcony railings and guardrails.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Placement of anchors in concrete.

B. Section 04 2000 - Unit Masonry: Placement of anchors in masonry.

C. Section 05 5100 - Metal Stairs: Handrails other than those specified in this section.

D. Section 05 5100 - Metal Stairs: Attachment plates for handrails specified in this section.

E. Section 06 2000 - Finish Carpentry: Wood handrail.

F. Section 08 8000 - Glazing: Glass baluster infill.

G. Section 09 2116 - Gypsum Board Assemblies: Placement of backing plates in stud wall construction.

H. Section 09 9113 - Exterior Painting: Paint finish.

I. Section 09 9123 - Interior Painting: Paint finish.

J. Section 10 1400 - Signage: Photoluminescent markings.

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2014 (2015 Errata).

B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.

C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.

D. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.

E. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.

F. AISC 201 - AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures 2006.

G. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2018.

H. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

I. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2013.

J. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2014.

K. ASTM B177/B177M - Standard Guide for Engineering Chromium Electroplating 2011 (Reapproved 2017).

L. ASTM B211 - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire 2012.

M. ASTM B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold-Finished Bar, Rod, and Wire (Metric) 2012.

N. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube 2016.

O. ASTM B429/B429M - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube 2010e1.

P. ASTM B483/B483M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Tubes for General Purpose Applications 2013, with Editorial Revision (2014).

Q. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings 2013, with Editorial Revision.

R. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings 2000 (Reapproved 2006).

S. ASTM E2072 - Standard Specification for Photoluminescent (Phosphorescent) Safety Markings 2014.

T. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2012.

U. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel 2017.

V. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 1999 (Ed. 2004).

W. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic") 2002 (Ed. 2004).

X. UL 1994 - Luminous Egress Path Marking Systems Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

2. Include the design engineer's seal and signature on each sheet of shop drawings.

C. Samples: Submit two, long samples of handrail. Submit two samples of elbow, wall bracket and end stop.

D. Designer's Qualification Statement.

E. Fabricator's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in Maryland, or personnel under direct supervision of such an engineer.

B. Welder Qualifications: Show certification of welders employed on the Work, verifying AWS qualification within the previous 12 months.

C. Fabricator Qualifications:

1. A qualified steel fabricator that is certified by the American Institute for Steel Construction (AISC) under AISC 201.

2. A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.
3. A company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Handrails and Railings:
1. Alumi-Guard: www.alumi-guard.com/#sle.
2. C.R. Laurence Company, Inc; CRL Welded Post Railing Systems (WRS): www.crl-arch.com/#sle.
3. Kee Safety, Inc; Kee Klamp (steel): www.keesafety.com/#sle.
4. Spaceguard Products; BeastWire Mezzanine Safety Railguard System: www.spaceguardproducts.com/#sle.
5. Superior Aluminum Products, Inc; Series 500: www.superioraluminum.com/#sle.
6. Substitutions: See Section 01 6000 - Product Requirements.

B. Non-Weld Pipe Fittings:
1. Kee Safety, Inc; Kee Klamp (steel): www.keesafety.com/#sle.
2. Substitutions: See Section 01 6000 - Product Requirements.

C. Metal Rail Infill:
1. The G-S Company: www.g-sco.com/#sle.
2. The Western Group; Woven Wire: www.architecturalwire.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

D. Photoluminescent Handrail Strips:
1. Safe-T-Nose, LLC: www.safetnose.com/#sle.
2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 RAILINGS - GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of ASTM E985 and applicable local code.

B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 75 pounds per linear foot (1095 N/m) applied to the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935

C. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds (890 N) applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935

D. Allow for expansion and contraction of members and building movement without damage to connections or members.

E. Dimensions: See drawings for configurations and heights.
1. Top Rails and Wall Rails: 1-1/2 inches (38 mm) diameter, round.
2. Top Rails and Wall Rails: Wood rails, specified in Section 06 2000.
3. Intermediate Rails: 1-1/2 inches (38 mm) diameter, round.

4. Intermediate Rails: 1-1/4 by 1 inch (32 by 25 mm) rectangular.
5. Posts: 1-1/2 inches (38 mm) diameter, round.
6. Posts: 1-1/2 inches (38 mm) square.
7. Balusters: 1/2 inch (12 mm) square solid bar.

F. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.

1. For anchorage to concrete, provide inserts to be cast into concrete, for bolting anchors.
2. For anchorage to masonry, provide brackets to be embedded in masonry, for bolting anchors.
3. For anchorage to stud walls, provide backing plates, for bolting anchors.
4. Posts: Provide adjustable flanged brackets.

G. Provide slip-on non-weld mechanical fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

H. Photoluminescent Handrail Strips: Manufacturer's standard clear anodized aluminum extrusion with embedded photoluminescent strip, complies with UL 1994 and ASTM E2072.

1. Attachment: Provide manufacturer approved field applied adhesive, factory applied adhesive and mechanical fasteners.

2.03 ALUMINUM MATERIALS

A. Aluminum Pipe: Schedule 40; ASTM B429/B429M, ASTM B241/B241M, or ASTM B483/B483M.

B. Aluminum Tube: Minimum wall thickness of 0.127 inch (3.2 mm); ASTM B429/B429M, ASTM B241/B241M, or ASTM B483/B483M.

C. Solid Bars and Flats: ASTM B211 (ASTM B211M).

D. Welding Fittings: No exposed fasteners; cast aluminum.

E. Straight Splice Connectors: Concealed spigot; cast aluminum.

2.04 STEEL RAILING SYSTEM

A. Steel Tube: ASTM A500/A500M Grade B cold-formed structural tubing.

B. Steel Pipe: ASTM A53/A53M Grade B Schedule 80, black finish.

C. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

D. Straight Splice Connectors: Steel concealed spigots.

E. Plastic Handrail Cover: Extruded PVC.

1. Color(s): As indicated on drawings.

F. Galvanizing: In accordance with requirements of ASTM A123/A123M.

1. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic.

G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

H. Chrome Plating: ASTM B177/B177M, nickel-chromium alloy, thickness [_____] , satin finish.

2.05 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.

B. Fit and shop assemble components in largest practical sizes for delivery to site.

C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

D. Welded Joints:

1. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.

2. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.

3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Install continuous plastic handrail cover. Heat weld joints and trim smooth.

2.06 ALUMINUM FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.

B. Class II Natural Anodized Finish: AAMA 611 AA-M12C22A31 Clear anodic coating not less than 0.4 mils (0.01 mm) thick.

C. Class I Color Anodized Finish: AAMA 611 AA-M12C22A44 Electrolytically deposited colored anodic coating not less than 0.7 mils (0.018 mm) thick.

D. Class II Color Anodized Finish: AAMA 611 AA-M12C22A34 Electrolytically deposited colored anodic coating not less than 0.4 mils (0.01 mm) thick.

E. Pigmented Organic Coating System: AAMA 2603 polyester or acrylic baked enamel finish.

F. High Performance Organic Coating System: AAMA 2604 multiple coat, thermally cured fluoropolymer system.

G. Superior Performance Organic Coating System: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride system.

H. Color: As indicated on drawings.

I. Touch-Up Materials: As recommended by coating manufacturer for field application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.

C. Apply one coat of bituminous paint to concealed aluminum surfaces that will be in contact with cementitious or dissimilar materials.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.

C. Install railings in compliance with ADA Standards for accessible design at applicable locations.

D. Anchor railings securely to structure.

E. Field weld anchors as indicated on drawings. Touch-up welds with primer. Grind welds smooth.

F. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

C. Maximum Out-of-Position: 1/4 inch (6 mm).

3.05 SCHEDULE

A. Stairs A and B: Flat steel bar railing system, plastic handrail cover, primed finish.

B. Stair C: Aluminum pipe railings, high performance organic finish.

END OF SECTION

SECTION 05 5305
METAL GRATINGS AND FLOOR PLATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formed metal floor, mezzanine and stair tread gratings.

B. Flat surface floor and stair tread plating.

C. Perimeter closure.

1.02 RELATED REQUIREMENTS

A. Section 05 5000 - Metal Fabrications.

B. Section 05 5100 - Metal Stairs: Framing for grating and stair treads.

C. Section 07 9513 - Expansion Joint Cover Assemblies.

D. Section 09 9113 - Exterior Painting: Field paint finish.

E. Section 09 9123 - Interior Painting: Field paint finish.

F. Section 33 0513 - Manholes and Structures.

G. Section 33 4211 - Stormwater Gravity Piping.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2017.

D. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.

E. ASTM B211 - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire 2012.

F. ASTM B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold-Finished Bar, Rod, and Wire (Metric) 2012.

G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2014.

H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2013.

I. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2012.

J. AWS D1.1/D1.1M - Structural Welding Code - Steel 2015, with Errata (2016).

K. NAAMM MBG 531 - Metal Bar Grating Manual 2017.

L. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 1999 (Ed. 2004).

M. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic") 2002 (Ed. 2004).

N. SSPC-SP 2 - Hand Tool Cleaning 1982, with Editorial Revision (2004).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide span and deflection tables.

C. Shop Drawings: Indicate details of component supports, openings, perimeter construction details, and tolerances.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

2. Include the design engineer's seal and signature on each sheet of shop drawings.

D. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

E. Designer's Qualification Statement.

F. Manufacturer's Installation Instructions: Indicate special requirements for opening and perimeter framing.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design gratings and plates under direct supervision of a Professional Structural Engineer experienced in design of this type of work and licensed in Maryland.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Ross Technology Corporation: www.rosstechnology.com/#sle.

B. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Comply with applicable code for loading requirements.

B. Maximum Allowable Deflection Under Live Load: 1/240 of span; size components by single support design.

C. Maximum Spacing Between Bars: To restrict pedestrian shoe heels.

D. Maximum Spacing Between Bars: 4".

2.03 MATERIALS

A. Steel Floor Plate: ASTM A786/A786M; manufacturer's standard pattern.

B. Sheet Steel for Die Stamping: ASTM A1011/A1011M Designation CS hot-rolled sheet.

C. Steel For Welding or Riveting: ASTM A36/A36M unfinished, of shapes indicated.

D. Steel Sheet for Lock Forming: Hot-dipped galvanized, ASTM A653/A653M, FS Type B, with G90/Z275 coating.

E. Steel Framing: ASTM A36/A36M shapes, unfinished.

F. Aluminum For Lock Forming: ASTM B221 ASTM B221M extruded, shapes as indicated.

G. Cross Bars: ASTM B211 ASTM B211M solid bars.

H. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

I. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

J. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.04 ACCESSORIES

A. Fasteners and Saddle Clips: Galvanized steel:

B. Perimeter Closure: Of same material as grating.

2.05 FABRICATION

A. Grating Type: NAAMM MBG 531, Pressure Locked Type.

B. Mechanically clinch joints of intersecting metal sections.

C. Fabricate support framing for openings.

D. Top Surface: Serrated.

2.06 FINISHES

A. Prepare surfaces to be primed in accordance with SSPC-SP 2.

B. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

C. Do not prime surfaces in direct contact with concrete or where field welding is required.

D. Prime paint items with one coat.

E. Galvanizing for Steel Shapes: ASTM A123/A123M.

F. Galvanizing for Steel Hardware: ASTM A153/A153M.

G. Aluminum: Mill finish.

H. Non-Slip Surfacing: Aluminum oxide.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated on drawings.

B. Verify that opening sizes and dimensional tolerances are acceptable.

C. Verify that supports are correctly positioned.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions.

B. Place frames in correct position, plumb and level.

C. Mechanically cut galvanized finish surfaces. Do not flame cut.

D. Anchor by welding.

E. Set perimeter closure flush with top of grating and surrounding construction.

F. Secure to prevent movement.

3.03 TOLERANCES

A. Comply with NAAMM MBG 531.

3.04 SCHEDULES

A. Mezzanine: Manufactured die stamped type, serrations facing upward, galvanized steel, 200 lb/sq ft (976 kg/sq m) live load.

B. Stair Treads to Main Mezzanine: Pressure locked aluminum bars, mill finish, 75 lb/sq ft (367 kg/sq m) live pedestrian load.

C. Stair Treads to Special Mezzanine: Pressure locked aluminum bars, 1/4 by 1-1/2 inch (6 by 38 mm) main bars, 1/4 by 3/4 inch (6 by 19 mm) cross bars, mill finish.

END OF SECTION

SECTION 11 5215
INTERACTIVE WHITEBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interactive whiteboards/markerboards.

1.02 RELATED REQUIREMENTS

A. Section 06 1000: Rough Carpentry

B. Section 09 2116: Gypsum Board Assemblies

C. Section 09 2216: Non-Structural Metal Framing

D. Section 26 0530: Conduits, Raceways, Fitting and Cable Trays

E. Section 26 0537: Wire, Cable and Connectors

F. Section 27 0500: LAN Wiring Specifications

1.03 REFERENCE STANDARDS

A. ANSI A135.4 – American Standard for Basic Hard Board; 2012

B. ASTM C1396/C1396M – Standard Specification for Gypsum Board; 2017

C. ASTM E84 – Standard Test Methods for Surface Burning Characteristics of Building Materials; 2018b

D. PS 1 – Structural Plywood; 2009.

E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL (DIR) - Online Certifications Directory Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

C. The work covered by this section of the specifications shall include all material, labor, hardware, software, firmware and programming to install interactive whiteboards as described herein and shown on the drawings.

D. System shall utilize PGCPS shared data network, and not require the use of any proprietary switches, routers or other network components. Physical network connections shall be provided by PGCPS' specified contractor.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate wall elevations, dimensions, joint locations, special anchoring details.

C. Cut sheets: indication specific manufactures information on software, model and accessories (mobile stand, pens, remote, etc.).

D. Manufacturer’s printed installation instructions and quality statement.

E. Installer's Qualification Statement.

F. Maintenance Contracts.

G. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

H. Project Record Documents: Record actual locations of all boards locations and model numbers.

I. Software: Copy of software provided under this section.

J. Maintenance Materials: Furnish the following for Owner's use in the maintenance of project:

1. Extra Stock Materials: Provide 5% attic stock of equipment or replacement bulbs, fuses, etc. for all equipment provided under this section.

2. Tools: One each of every special tool required for maintenance of specified equipment.
3. Maintenance Data: Include data on regular upkeep cleaning, thorough cleaning, removing permanent marker ink, sensor cleaning, etc.

1.06 **QUALITY ASSURANCE**

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

C. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

D. Testing and Certification: Interactive display provider must invest in accelerated life testing (ALT) to demonstrate expected failure rate, life of the product and make design changes to mitigate risk

1.07 **MOCK-UP**

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

1.08 **DELIVERY, STORAGE, AND HANDLING**

A. Deliver products to project site in factory packaging.

1.09 **WARRANTY**

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty for warranty against pixilation; backlight power issues, general electrical defects, or manufacturer’s defects, etc.

D. Warranty upgrade: Three (3) year upgrade to onsite support with remote support.

E. Provide one-year warranty for floor stands, speakers, and mobile stands from date of purchase.

PART 2 PRODUCTS

2.01 **MANUFACTURERS**

A. Boxlight (www.boxlight.com).

B. Smart (www.smarttech.com).

C. Viewsonic (www.viewsonic.com).

2.02 **EQUIPMENT REQUIREMENTS**

A. Basis of Design Manufacturer: reference BOD.

B. General:
1. At a minimum, interactive display models must be available with a 75-inch screen size (diagonal).
2. Board/Panel can function without a supplementary device (laptop, tablet) Runs an independent operating system preferably Microsoft Windows
3. Must be a Stand-alone panel
4. Board can be mobile on cart or mounted to wall/structure
5. Unit shall carry Energy Star certification
6. Display must integrate with other products from the display provider, including software, document cameras, speakers and classroom audio systems
7. Unit shall be provided with all required cables including USB, HDMI, power, audio, etc.
8. Must feature 4K UHD (ultra-high definition) resolution as well ass support 4K UHD 60Hz digital input.

C. Performance:
1. Units shall be equipped with the following:
   a. Wired ethernet and wireless internet connection
   b. Bluetooth connection

c. Auxiliary remote control
d. Ease of connection and display with PC, Apple and Android devices
e. HDMI connections
f. Interactive pens or other tools including ability to draw or activate features by finger
g. Automatic software updates for ease of function
h. Touch screen
i. Video conferencing
j. Integrated speaker system and ability to output audio through external speakers
k. Memory and Storage capabilities (including storage to Google Drive)

D. Information Technology Hardware and Software Requirements
1. Prouduct must be capable of running an independent Operating System (i.e. - Chrome OS).
2. Shall have ability to connect to a hardwired network via ethernet port.
3. Software shall have ability to support enterprise wireless - 802.11x
4. Unit shall support user installed SSL certificates.
5. Unit shall have a minimum of three (3) USB inputs.
6. Unit shall have two (2) HDMI inputs.
7. Unit shall have one (1) 3.5 mm audio input.
8. Unit shall have one (1) 3.5 mm audio output.
9. Corded power cable connection only; no hard wired equipment.

E. Mounting Carts
1. Legs on mobile stand shall not be tripping hazard.
2. Owner preferred option: shelving below board.
3. Mounting carts shall be adjustable such that unit height should be easily adjustable for variable student heights.

2.03 **SOURCE QUALITY CONTROL**

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Non-Complying Work: See Section 01 4000 - Quality Requirements.

PART 3 EXECUTION

3.01 **INSTALLATION**

A. Install in accordance with manufacturer's instructions.

B. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.
1. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.
2. Verify flat wall surface

C. Refer to educational specifications for mounting heights of boards in classrooms.

D. Systems Integration:
1. All connections to PGCPS network shall be done in accordance with Section 27 0500 - LAN Wiring Specifications.
2. Verify in field that equipment is installed plum and level.
3. Mounting system shall include all necessary accessories and devices for complete installation and operation. Finch/color shall be coordinated with the architect. Ensure all equipment is hung on manufacturer approved brackets, etc. according to equipment weights. All connections to walls shall be coordinated with wall types outlined in architectural drawings.
4. Connection ports shall be coordinated with in-school staff and PGCPS Information Technology.

3.02 **CLEANING**

A. Clean board surfaces in accordance with manufacturer's instructions.

B. Cover with protective cover, taped to frame.

C. Remove temporary protective cover at Date of Substantial Completion.

3.03 **CLOSEOUT ACTIVITIES**

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate operation of system to Owner's personnel.
   1. Use operation and maintenance data as reference during demonstration.
   2. Briefly describe function, operation, and maintenance of each component.

D. Training: Train Owner's personnel on operation and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Manufacturer's training personnel.
   4. Location: At project site.

3.04 **PROTECTION**

3.05 **MAINTENANCE**

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide a separate maintenance contract for specified maintenance service.

END OF SECTION

SECTION 06 0573
WOOD TREATMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Site applied termiticide for wood materials.

B. Site applied termiticide for other building materials.

C. Site applied mildewcide for wood materials.

D. Site applied preservative treatment for wood materials.

E. Site applied fire-retardant treatment for wood materials.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions .

B. Section 03 3000 - Cast-in-Place Concrete.

C. Section 06 1000 - Rough Carpentry: Factory treatment for wood products.

D. Section 06 1219 - Structural Insulated Panels: Factory treatment for wood products.

E. Section 06 1323 - Heavy Timber Framing: Factory treatment for wood products.

F. Section 06 1500 - Wood Decking: Factory treatment for wood products.

G. Section 06 1733 - Wood I-Joists: Factory treatment for wood products.

H. Section 06 1736 - Metal-Web Wood Joists: Factory treatment for wood products.

I. Section 06 1753 - Shop-Fabricated Wood Trusses: Factory treatment for wood products.

J. Section 06 1800 - Glued-Laminated Construction: Factory treatment for wood products.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide technical data on insulated sheathing, wood preservative materials and application instructions.

C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

1.05 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Site Applied Termiticide and Mildewcide: Correct defective Work within a twenty-five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty for all materials.

PART 2 PRODUCTS

2.01 SITE-APPLIED WOOD TREATMENT

A. Site Applied Termiticide for Wood: Borate mineral salt based, spray applied, penetrating termiticide.

B. Site Applied Termiticide and Mildewcide: Borate mineral salt based, spray applied termiticide, mildewcide and mold growth preventative.

C. Site Applied Termiticide for Wood, Steel and Concrete: Borate mineral salt based, spray applied termiticide formulated for use on wood, steel, concrete and other building materials.

1. Active Ingredient: 40% minimum disodium octaborate tetrahydrate (DOT).

2. Carrier and Penetrant: Proprietary glycol solution.

D. Site Applied Mold Cleaner: Non-bleaching, oxidizer based formula with high-pH tolerant surfactant. Contains no sodium hydroxide or sodium hypochlorite.

E. Surface-Applied Wood Preservative:

F. Surface-Applied Fire-Retardant:

PART 3 EXECUTION

3.01 PREPARATION

A. Remove dust, dirt and other contaminants from treatment surfaces. Remove tarpaulins, dropcloths, strippable protective films, etc., from areas to be treated Move equipment and stored materials that block or prevent product application.

3.02 INSTALLATION - GENERAL

A. Provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 SITE APPLIED WOOD TREATMENT

A. Comply with manufacturers written mixing and installation instructions.

B. Termiticide: Apply to foundations, structure and other items as listed.

1. All structural wood and sill plates within 24 inches (610 mm), minimum, of point of contact with foundation.

2. All wood, wood based and cellulosic sheathing within 24 inches (610 mm), minimum, of point of contact with foundation.

3. Concrete foundations 2 inches (51 mm), minimum, from sill plate.

4. Open bath traps and concrete slab within 12 inches (305 mm), minimum, of bath trap.

5. All pipe and plumbing penetrations up to 24 inches (305 mm), minimum, above slab and slab surface within 6 inches (152 mm), minimum, of pipe or penetration.

6. Concrete or masonry crawlspace walls up to 24 inches (610 mm), minimum, from top of soil.

7. Concrete or masonry basement walls up to 24 inches (610 mm), minimum, from top of soil.

8. Six inches (152 mm), minimum, on either side of control joints and construction joints in slabs and joints between slabs and abutting material.

C. Mildewcide: Apply to wood and wood based building materials as listed.

1. All structural wood and sill plates within 24 inches (610 mm), minimum, of point of contact with foundation.

2. All wood, wood based and cellulosic sheathing within 24 inches (610 mm), minimum, of point of contact with foundation.

END OF SECTION

SECTION 06 1000
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exposed timber structural framing.

B. Rough opening framing for doors, windows, and roof openings.

C. Subflooring.

D. Underlayment.

E. Roof-mounted curbs.

F. Roofing nailers.

G. Roofing cant strips.

H. Preservative treated wood materials.

I. Fire retardant treated wood materials.

J. Miscellaneous framing and sheathing.

K. Communications and electrical room mounting boards.

L. Concealed wood blocking, nailers, and supports.

M. Miscellaneous wood nailers, furring, and grounds.

N. Wall sheathing with factory applied water-resistive and air barrier sheet.

O. Roof sheathing with factory applied roofing underlayment.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 03 3000 - Cast-in-Place Concrete: Setting anchors in concrete.

C. Section 03 5400 - Cast Underlayment.

D. Section 05 1200 - Structural Steel Framing: Prefabricated beams and columns for support of wood framing.

E. Section 05 5000 - Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing.

F. Section 06 1219 - Structural Insulated Panels.

G. Section 06 1323 - Heavy Timber Framing.

H. Section 06 1326 - Heavy Timber Trusses.

I. Section 06 1500 - Wood Decking.

J. Section 06 1733 - Wood I-Joists.

K. Section 06 1736 - Metal-Web Wood Joists.

L. Section 06 1753 - Shop-Fabricated Wood Trusses.

M. Section 06 1800 - Glued-Laminated Construction.

N. Section 07 2500 - Weather Barriers: Air barrier over sheathing.

O. Section 07 2500 - Weather Barriers: Water-resistive barrier over sheathing.

P. Section 07 6200 - Sheet Metal Flashing and Trim: Sill flashings.

Q. Section 07 7200 - Roof Accessories: Prefabricated roof curbs.

R. Section 09 2116 - Gypsum Board Assemblies: Gypsum-based sheathing.

S. Section 31 3116 - Termite Control: Field-applied termiticide and mildewcide for wood materials.

1.03 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard 2009.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2017.

D. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board 2012.

E. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation 2018.

F. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing 2013.

G. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.

H. ASTM D2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing 2010 (Reapproved 2017).

I. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2016.

J. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials 2013.

K. ASTM E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies 2018.

L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2018b.

M. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.

N. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015.

O. AWPA U1 - Use Category System: User Specification for Treated Wood 2017.

P. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

Q. ICC (IECC) - International Energy Conservation Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

R. ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers 2016.

S. ICC-ES AC310 - Acceptance Criteria for Water-resistive Membranes Factory-bonded to Wood-based Structural Sheathing, Used as Water-Resistive Barriers 2008, with Editorial Revision (2015).

T. ICC-ES AC380 - Acceptance Criteria for Termite Physical Barrier Systems 2014, with Editorial Revision (2017).

U. PS 1 - Structural Plywood 2009.

V. PS 2 - Performance Standard for Wood-Based Structural-Use Panels 2010.

W. PS 20 - American Softwood Lumber Standard 2015.

X. RIS (GR) - Standard Specifications for Grades of California Redwood Lumber 2000.

Y. SPIB (GR) - Grading Rules 2014.

Z. WCLIB (GR) - Standard Grading Rules for West Coast Lumber No. 17 2015.

AA. WWPA G-5 - Western Lumber Grading Rules 2017.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide technical data on insulated sheathing, wood preservative materials and application instructions.

C. Structural Composite Lumber: Submit manufacturer's published structural data including span tables, marked to indicate which sizes and grades are being used; if structural composite lumber is being substituted for dimension lumber or timbers, submit grading agency structural tables marked for comparison.

D. ABAA Field Quality Control Submittals: Submit third-party reports of testing and inspection required by ABAA QAP.

E. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

F. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

G. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification. Keep copies of all contractor accreditation and installer certification on site during and after installation. Present on-site documentation upon request.

H. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); www.airbarrier.org/#sle:

1. Installer Qualification: Use accredited contractor, certified installers, evaluated materials, and third-party field quality control audit.

2. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture. Use secondary materials approved in writing by primary material manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty for all lumber.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.

1. Species: Douglas Fir-Larch, unless otherwise indicated.
2. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
3. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
4. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.

B. Lumber fabricated from old growth timber is not permitted.

C. Provide sustainably harvested wood; see Section 01 6000 - Product Requirements for requirements.

D. Provide wood harvested within a 500 mile (805 km) radius of the project site.

E. Lumber salvaged from deconstruction or demolition of existing buildings or structures is permitted in lieu of sustainably harvested lumber provided it is clean, denailed, and free of paint and finish materials, and other contamination; identify source.

1. Where salvaged lumber is used for structural applications, provide lumber re-graded by an inspection service accredited by the American Lumber Standard Committee, Inc; www.alsc.org.

F. Lumber fabricated from recovered timber (abandoned in transit) is permitted in lieu of sustainably harvested lumber, unless otherwise noted, provided it meets the specified requirements for new lumber and is free of contamination; identify source.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).

B. Sizes: Nominal sizes as indicated on drawings, S4S.

C. Moisture Content: S-dry or MC19.

D. Stud Framing (2 by 2 through 2 by 6 (50 by 50 mm through 50 by 150 mm)):

1. Species: Any allowed under referenced grading rules.
2. Grade: No. 2.

E. Joist, Rafter and Small Beam Framing (2 by 6 through 4 by 16 (50 by 150 mm through 100 by 400 mm)):

1. Machine stress-rated (MSR) as follows:
   a. Fb-single (minimum extreme fiber stress in bending): 1350 psi (9,300 kPa).
   b. E (minimum modulus of elasticity): 1,300,000 psi (8960 MPa).
2. Species: Douglas Fir-Larch.

F. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:

1. Lumber: S4S, No. 2 or Standard Grade.
2. Boards: Standard or No. 3.

2.03 STRUCTURAL COMPOSITE LUMBER

A. At Contractor 's option, structural composite lumber may be substituted for concealed dimension lumber and timbers.

B. Structural Composite Lumber: Factory fabricated beams, headers, and columns, of sizes and types indicated on drawings; structural capacity as published by manufacturer.

1. Columns: Use laminated veneer lumber, laminated strand lumber or parallel strand lumber with manufacturer's published E (modulus of elasticity): 1,800,000 psi (12,410 MPa), minimum.
2. Beams: Use laminated veneer lumber, laminated strand lumber or parallel strand lumber with manufacturer's published E (modulus of elasticity): 1,800,000 psi (12,410 MPa), minimum.
3. Headers Not Longer Than 48 inches (1220 mm): Use laminated veneer lumber, laminated strand lumber or parallel strand lumber.
4. Manufacturers:
    a. Boise Cascade Company: www.bc.com/#sle.
    b. Weyerhaeuser Company: www.weyerhaeuser.com/#sle.
    c. Substitutions: See Section 01 6000 - Product Requirements.

2.04 CONSTRUCTION PANELS

A. Subfloor/Underlayment Combination: Any PS 2 type, rated Single Floor.
1. Bond Classification: Exterior.
2. Span Rating: 48.
3. Performance Category: 1-1/8 PERF CAT.
4. Edges: Tongue and groove.

B. Subfloor/Underlayment Combination: Oriented strand board wood structural panel; PS 2, rated Single Floor.
1. Bond Classification: Exterior.
2. Performance Category: 19/32 PERF CAT.
3. Span Rating: 20.
4. Edges: Square.
5. Surface Finish: Fully sanded face.
6. Exposure Time: Sheathing will not delaminate or require sanding due to moisture absorption from exposure to weather for up to 200 days.
7. Provide fastening guide on top panel surface with separate markings indicating fastener spacing for 16 inches (406 mm), 19.2 inches (488 mm) and 24 inches (610 mm) on center, respectively.
8. Warranty: Manufacturer's standard lifetime limited warranty against manufacturing defects and that panels will not delaminate or require sanding due to moisture absorption damage from exposure to weather for up to the stated period.
9. Manufacturers:
    a. Weyerhaeuser Company: www.weyerhaeuser.com/#sle.
    b. Substitutions: See Section 01 6000 - Product Requirements.

C. Subflooring: Any PS 2 type, rated Sheathing.
1. Bond Classification: Exterior.
2. Span Rating: 48.
3. Performance Category: 3/4 PERF CAT.

D. Subflooring: Particleboard, ANSI A208.1, Grade M-2 EXTERIOR GLUE waferboard; 3/4 inch (19 mm) thick, square edge.

E. Subflooring: Magnesium oxide board.
   1. Classification: PS 2, Exposure 1.
   2. Panel Thickness: 3/4 inch (19 mm), nominal.
   3. Span: 24 inches (610 mm), maximum.
   4. Fire Resistance: ASTM E84, Class A1; zero flame spread and zero smoke developed.
   5. Mold and Mildew Resistance: Zero growth when tested according to ASTM G21.
   6. Manufacturers:
      a. Extremegreen Building Products, LLC; Extremegreen® Sub-Flooring: www.extremegreenbp.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

F. Underlayment: APA Underlayment; plywood, Exposure 2, 1/2 inch (12.5 mm) thick. Fully sanded faces at resilient flooring.

G. Underlayment: Particleboard, ANSI A208.1, Grade PBU.

H. Roof Sheathing: Any PS 2 type, rated Structural I Sheathing.
   1. Bond Classification: Exterior.
   2. Span Rating: 60.
   3. Performance Category: 3/4 PERF CAT.

I. Roof Sheathing: Particleboard, ANSI A208.1, Grade M-3 EXTERIOR GLUE; square edges, with panel clips.

J. Roof Sheathing: Oriented strand board wood structural panel; PS 2.
   1. Grade: Structural 1 Sheathing.
   2. Bond Classification: Exposure 1.
   3. Performance Category: 5/8 PERF CAT.
   4. Span Rating: 40/20.
   5. Edges: Square.
   6. Exposure Time: Sheathing will not delaminate or require sanding due to moisture absorption from exposure to weather for up to 500 days.
   7. Provide fastening guide on top panel surface with separate markings indicating fastener spacing for 16 inches (406 mm) and 24 inches (610 mm) on center, respectively.
   8. Warranty: Manufacturer's standard lifetime limited warranty against manufacturing defects and that panels will not delaminate or require sanding due to moisture absorption damage from exposure to weather for up to the stated period.

K. Roof Sheathing: Oriented strand board structural wood panel, PS 2, with factory laminated roofing underlayment layer.
   1. Sheathing Panel:
      a. Grade: Structural 1 Sheathing.
      b. Size: 4 feet (1219 mm) wide by 8 feet (2438 mm) long.
      c. Performance Category: 5/8 PERF CAT.

d. Span Rating: 40/20.

e. Edge Profile: Square edge.

2. Integral Roofing Underlayment Layer: Medium density, phenolic impregnated kraft paper overlay.

3. Exposure Time: Sheathing undamaged and integral roofing underlayment layer intact after exposure to weather for up to 180 days.

4. Provide fastening guide on top panel surface with separate markings indicating fastener spacing for 16 inches (406 mm) and 24 inches (610 mm) on center.

5. Seam Tape: Manufacturer's standard pressure-sensitive, self-adhering, cold-applied seam tape consisting of polyolefin film with acrylic adhesive.

6. Warranty: Manufacturer's standard 30 year limited system warranty of:

a. Performance: Panel and tape resistance to water penetration; tape adhesion.

b. Material: Free from manufacturing defects and panel delamination.

L. Roof Sheathing: Oriented strand board wood structural panel; PS 2, with factory-applied fire-retardant treatment and fire-resistant cementitious facer.

1. Grade: Structural 1 Sheathing.

2. Bond Classification: Exposure 1.

3. Performance Category: 5/8 PERF CAT.

4. Span Rating: 40/20.

5. Edges: Square.

6. Provide fastening guide on top panel surface with separate markings indicating fastener spacing for 16 inches (406 mm) and 24 inches (610 mm) on center, respectively.

M. Wall Sheathing: Any PS 2 type.

1. Bond Classification: Exterior.

2. Grade: Structural I Sheathing.

3. Span Rating: 24.

4. Performance Category: 5/16 PERF CAT.

5. Edge Profile: Square edge.

N. Wall Sheathing: Particleboard, ANSI A208.1, Grade M-3 EXTERIOR GLUE.

O. Wall Sheathing: Fiberboard, ASTM C208, Type IV, Grade 1 regular, square edges.

P. Wall Sheathing: See Section 09 2116.

Q. Wall Sheathing: Gypsum, complying with requirements of ASTM C1396/C1396M for gypsum sheathing, V-shaped long edges, 5/8 inch Type X fire resistant (16 mm Type X fire resistant).

R. Wall Sheathing: Oriented strand board structural wood panel with factory laminated water-resistive and air barrier layer.

1. Sheathing Panel: PS 2, Exposure 1.

a. Size: 4 feet (1219 mm) wide by 8 feet (2438 mm) long.

b. Grade: Sheathing.

c. Performance Category: 7/16 PERF CAT.

d. Span Rating: 24/16.

e. Edge Profile: Square edge.

2. Integral Water-Resistive and Air Barrier: Sheet material qualifying as a Grade D water resistive barrier; complying with ICC-ES AC310.

3. Water Vapor Permeance of Water Resistive and Air Barrier: 12 to 16 perms (689 to 918 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M Procedure B.

4. Maximum Allowable Air Leakage of Assembly, complying with ASTM E2357:

a. Infiltration: 0.0072 cfm per square foot (0.037 L/s per sq m), maximum, at a pressure differential of 1.57 pounds per square foot (75 Pa).

b. Exfiltration: 0.0023 cfm per square foot (0.012 L/s per sq m), maximum, at a pressure differential of 1.57 pounds per square foot (75 Pa).

5. Provide fastening guide on top panel surface with separate markings indicating fastener spacing for 16 inches (406 mm) and 24 inches (610 mm) on center, respectively.

6. Seam Tape: Manufacturer's standard pressure-sensitive, self-adhering, cold-applied, seam tape.

7. Warranty: Manufacturer's standard 30 year limited system warranty of:

a. Performance: Panel and tape resistance to water penetration; tape adhesion.

b. Material: Free from manufacturing defects and panel delamination.

S. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch (19 mm) thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.05 ACCESSORIES

A. Fasteners and Anchors:

1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.

2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.

3. Anchors: Toggle bolt type for anchorage to hollow masonry.

B. Joist Hangers: Hot dipped galvanized steel, sized to suit framing conditions.

C. Sill Gasket on Top of Foundation Wall: 1/4 inch (6 mm) thick, plate width, closed cell plastic foam from continuous rolls.

D. Termite-Resistant Sill Plate Barrier: Self-adhesive, film-backed barrier with release sheet; adheres to concrete substrates and blocks termite access.

1. Thickness: 68 mils (0.068 inch) (1.7 mm).

2. Termite Resistance: 100 percent when tested in accordance with ICC-ES AC380.

3. Water Vapor Permeance: 0.035 perm (2 ng/(Pa s sq m)), maximum, when tested in accordance with ASTM E96/E96M.

E. Termite-Resistant Sill Flashing: Self-adhesive membrane; polyethylene film bonded to sealant.

1. Thickness: 40 mils (0.040 inch) (1 mm).

2. Termite Resistance: 100 percent when tested in accordance with ICC-ES AC380.

3. Water Vapor Permeance: 0.035 perm (2 ng/(Pa s sq m)), maximum, when tested in accordance with ASTM E96/E96M.

F. Sill Flashing: As specified in Section 07 6200.

G. Subfloor Adhesives: Waterproof, air cure type, cartridge dispensed.

H. Construction Adhesives:

I. Building Paper: Water resistant Kraft paper.

2.06 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.

1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.

2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Fire Retardant Treatment:

1. Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.

a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.

b. Treat exposed exterior rough carpentry items, including stairways, balconies and covered walkways

c. Do not use treated wood in direct contact with the ground.

2. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.

a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.

b. All interior rough carpentry items are to be fire retardant treated.

c. Treat rough carpentry items as indicated .

d. Do not use treated wood in applications exposed to weather or where the wood may become wet.

C. Preservative Treatment:

1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.

a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.

b. Treat lumber exposed to weather.

c. Treat lumber in contact with roofing, flashing or waterproofing.

d. Treat lumber in contact with masonry or concrete.

e. Treat lumber less than 18 inches (450 mm) above grade.

2. Preservative Pressure Treatment of Plywood Above Grade: AWPA U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative.

a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.

b. Treat plywood in contact with roofing, flashing or waterproofing.

c. Treat plywood in contact with masonry or concrete.

d. Treat plywood less than 18 inches (450 mm) above grade.

3. Preservative Pressure Treatment of Lumber in Contact with Soil: AWPA U1, Use Category UC4A, Commodity Specification A using waterborne preservative.

a. Preservative for Field Application to Cut Surfaces: As recommended by manufacturer of factory treatment chemicals for brush-application in the field.

b. Restrictions: Do not use lumber or plywood treated with chromated copper arsenate (CCA) in exposed exterior applications subject to leaching.

PART 3 EXECUTION

3.01 PREPARATION

A. Where wood framing bears on cementitious foundations, install full width sill flashing continuous over top of foundation, lap ends of flashing minimum of 4 inches (100 mm) and seal.

B. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.

C. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.

C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

F. Provide the following specific non-structural framing and blocking:

1. Cabinets and shelf supports.
2. Wall brackets.
3. Handrails.
4. Grab bars.
5. Towel and bath accessories.
6. Wall-mounted door stops.
7. Chalkboards and marker boards.
8. Wall paneling and trim.
9. Joints of rigid wall coverings that occur between studs.

3.04 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

B. Provide wood curb at all roof openings except where prefabricated curbs are specified and where specifically indicated otherwise. Form corners by alternating lapping side members.

3.05 INSTALLATION OF CONSTRUCTION PANELS

A. Subflooring/Underlayment Combination: Glue and nail to framing; staples are not permitted.

B. Subflooring: Glue and nail to framing; staples are not permitted.

C. Underlayment: Secure to subflooring with nails and glue.

1. At locations where resilient flooring will be installed, fill and sand splits, gaps, and rough areas.
2. Place building paper between floor underlayment and subflooring.

D. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.

1. At long edges provide solid edge blocking where joints occur between roof framing members.
2. Nail panels to framing; staples are not permitted.

E. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws or staples.

1. Use plywood or other acceptable structural panels at building corners, for not less than 96 inches (2440 mm), measured horizontally.
2. Provide inlet diagonal bracing at corners.
3. Place water-resistive barrier horizontally over wall sheathing, weather lapping edges and ends.

F. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches (610 mm) on center on all edges and into studs in field of board.

1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
3. Install adjacent boards without gaps.
4. Size and Location: As indicated on drawings.

G. Wall Sheathing and Roof Sheathing with Laminated Water-Resistive Barrier and Air Barrier: Secure to studs as recommended by manufacturer.

1. Install with laminated water-resistive and air barrier on exterior side of sheathing.
2. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
3. Use only mechanically attached and drainable EIFS and exterior insulation with wall sheathing with laminated water-resistive and air barrier.
4. Apply manufacturer's standard seam tape to joints between sheathing panels. Use tape gun or hard rubber roller as recommended by manufacturer.

3.06 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.

B. Allow preservative to dry prior to erecting members.

3.07 TOLERANCES

A. Framing Members: 1/4 inch (6 mm) from true position, maximum.

B. Variation from Plane (Other than Floors): 1/4 inch in 10 feet (2 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.

3.08 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Coordination of ABAA Tests and Inspections:

1. Provide testing and inspection required by ABAA QAP.
2. Notify in ABAA writing of schedule for air barrier work. Allow adequate time for testing and inspection.
3. Cooperate with ABAA testing agency.
4. Allow access to air barrier work areas and staging.
5. Do not cover air barrier work until tested, inspected, and accepted.

3.09 CLEANING

A. Waste Disposal: Comply with the requirements of Section 01 7419 - Construction Waste Management and Disposal.

1. Comply with applicable regulations.
2. Do not burn scrap on project site.
3. Do not burn scraps that have been pressure treated.
4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 1323
HEAVY TIMBER FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Heavy structural timber for posts, beams, joists, purlins and [_____].

B. Connection hardware.

1.02 RELATED REQUIREMENTS

A. Section 03 1000 - Concrete Forming and Accessories: Placement of steel support fabrications.

B. Section 05 1200 - Structural Steel Framing: Steel support fabrications.

C. Section 05 5000 - Metal Fabrications: Steel support fabrications.

1.03 REFERENCE STANDARDS

A. AITC 108 - Standard For Heavy Timber Construction 1993.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

D. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2012.

E. AWS D1.1/D1.1M - Structural Welding Code - Steel 2015, with Errata (2016).

F. AWPA U1 - Use Category System: User Specification for Treated Wood 2017.

G. RIS (GR) - Standard Specifications for Grades of California Redwood Lumber 2000.

H. SPIB (GR) - Grading Rules 2014.

I. WCLIB (GR) - Standard Grading Rules for West Coast Lumber No. 17 2015.

J. WWPA G-5 - Western Lumber Grading Rules 2017.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate dimensions, wood species and grades, component profiles, drilled holes, fasteners, connectors, erection details and sequence.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

2. Include the design engineer's seal and signature on each sheet of shop drawings.

C. Product Data: Submit technical data on wood preservative materials, application instructions.

D. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

E. Designer's Qualification Statement.

F. Manufacturer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design members under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in Maryland.

B. Lumber Grading Agency: Certified by American Lumber Standards Committee.

C. Manufacturer Qualifications: Company specializing in manufacture of heavy timber framing, certified by American Institute of Timber Construction, with three years minimum experience.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Comply with applicable codes for loading, seismic zoning, fire retardant criteria, and other governing load criteria.

2.02 WOOD MATERIALS

A. Wood fabricated from old growth timber is not permitted.

B. Provide sustainably harvested wood; see Section 01 6000 - Product Requirements for requirements.

C. Provide wood harvested within a 500 mile (805 km) radius of the project site.

D. Lumber/Timbers salvaged from deconstruction or demolition of existing buildings or structures is permitted instead of sustainably harvested lumber provided it is clean, denailed, and free of paint and finish materials, and other contamination; identify source.

1. Where salvaged wood is used for structural applications, provide wood re-graded by an inspection service accredited by the American Lumber Standard Committee, Inc.

E. Lumber/Timbers fabricated from recovered timber (abandoned in transit) is permitted instead of sustainably harvested lumber, unless indicated otherwise, and provided it meets the specified requirements for new wood and is free of contamination; identify source.

F. Lumber Grading Rules: RIS (GR).

G. Lumber: Stress group [____]; [_____] species; [____] grade; maximum moisture content of [____] percent.

2.03 FABRICATION

A. Fabricate components in accordance with AITC 108, with joints neatly fitted, welded, and ground smooth.

2.04 WOOD TREATMENT

A. Wood Preservative (Pressure Treatment): AWPA U1, Use Category UC3B, Commodity Specification A, using waterborne preservative to 0.25 lb/cu ft retention (to 4.0 kg/cu m retention).

2.05 ACCESSORIES

A. Connectors: Type weldable steel. Provide [_____] manufactured by [_____] .

B. Bolts, Nuts, Washers, Lags, and Screws, Untreated Wood: Medium carbon steel; galvanized coating per ASTM A153/A153M; size and type to suit application.

C. Bolts, Nuts, Washers, Lags, and Screws, Preservative-Treated Wood: Stainless steel; size and type to suit application.

PART 3 EXECUTION

3.01 PREPARATION

A. Ensure that steel support fabrications are installed in correct locations and anchored securely.

3.02 ERECTION

A. Set structural members level and plumb, in correct position.

B. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.

C. Do not field cut or alter structural members without approval of Architect .

D. After erection, touch-up primed surfaces with primer.

END OF SECTION

SECTION 06 1326
HEAVY TIMBER TRUSSES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Heavy structural timber trusses.

B. Bridging, bracing, and anchorage.

C. Connection hardware.

D. Fire retardant treatment of wood.

E. Preservative treatment of wood.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Installation requirements for miscellaneous framing.

B. Section 06 1000 - Rough Carpentry: Material requirements for blocking, plates, and miscellaneous framing.

1.03 REFERENCE STANDARDS

A. AITC 108 - Standard For Heavy Timber Construction 1993.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2017.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2018b.

F. AWS D1.1/D1.1M - Structural Welding Code - Steel 2015, with Errata (2016).

G. AWPA U1 - Use Category System: User Specification for Treated Wood 2017.

H. RIS (GR) - Standard Specifications for Grades of California Redwood Lumber 2000.

I. SPIB (GR) - Grading Rules 2014.

J. UL (FRD) - Fire Resistance Directory Current Edition.

K. WWPA G-5 - Western Lumber Grading Rules 2017.

1.04 SUBMITTALS

A. Submit under provisions of Section 01 3000 - Administrative Requirements.

B. Shop Drawings: Indicate framing system, sizes and spacing of trusses, loads and truss cambers, and [_____]. Submit design calculations.

1. Indicate species and wood grades, component profiles, bearing and anchor details, bridging and bracing, framed openings, drilled holes, fasteners, connectors, erection details and sequence, and field splices.

2. Indicate welded connections using standard AWS D1.1/D1.1M welding symbols. Indicate net weld lengths.

C. Product Data: Provide data on proprietary connection devices and on wood preservative materials.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle products to site under provisions of Section 01 6000 - Product Requirements.

B. Store trusses in vertical position resting on bearing points and braced to prevent damage.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Comply with applicable codes for loading, seismic zoning, fire retardant criteria, and other governing load criteria.

2.02 HEAVY TIMBER TRUSSES

A. Trusses and Components: Fabricated in accordance with AITC 108, joints neatly fitted and accurately spaced.

1. Surface Texture of Timber: Rough sawn; on four sides.
2. Connectors: Prime except where cast in concrete or in contact with cementitious materials.
3. Minimum Truss Depth To Accommodate Mechanical Ducts:
4. Roof/Ceiling Fire Resistance Rating: 1 hour .
5. Floor/Ceiling Fire Resistance Rating: 1 hour.

2.03 WOOD MATERIALS

A. Wood fabricated from old growth timber is not permitted.

B. Provide sustainably harvested wood; see Section 01 6000 - Product Requirements for requirements.

C. Provide wood harvested within a 500 mile (805 km) radius of the project site.

D. Lumber/Timbers salvaged from deconstruction or demolition of existing buildings or structures is permitted in lieu of sustainably harvested lumber provided it is clean, denailed, and free of paint and finish materials, and other contamination; identify source.

1. Where salvaged wood is used for structural applications, provide lumber re-graded by an inspection service accredited by the American Lumber Standard Committee, Inc.

E. Lumber/Timbers fabricated from recovered timber (abandoned in transit) is permitted in lieu of sustainably harvested lumber, unless otherwise noted, provided it meets the specified requirements for new wood and is free of contamination; identify source.

F. Lumber Grading Rules: RIS (GR).

G. Wood Blocking, Plates, and Miscellaneous Framing: As specified in Section 06 1000.

2.04 CONNECTOR MATERIALS

A. Shop prime all connectors except leave surfaces bare where intended to be in contact with concrete or cementitious materials.

B. Steel Connectors: Structural steel, ASTM A36/A36M; galvanized in accordance with ASTM A123/A123M; size and thickness as indicated.

C. Steel Connector Plates: Hot-dipped galvanized, ASTM A653/A653M SS Grade 33/230, with G90/Z275 coating; size and thickness as indicated.

D. Steel Split Rings: ASTM A36/A36M, galvanized in accordance with ASTM A123/A123M; size and thickness as indicated.

E. Truss Bridging: Type, size and spacing recommended by truss manufacturer.

F. Bearing Plates: Electro-galvanized steel.

G. Bolts, Nuts, and Washers: Medium carbon steel, electro-galvanized; size and type to suit application.

H. Bearing Plate Anchors: Expansion shield type for anchorage to masonry or concrete.

I. Metal Primer: Galvanizing type.

2.05 WOOD TREATMENT

A. Factory Treated Timber: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.

B. Fire Retardant Treatment, Exterior Type: AWPA U1, Use Category UCFB, Commodity Specification H, chemically treated and pressure impregnated, with maximum flame spread index of 25 when tested in accordance with ASTM E84; kiln dried after treatment to maximum moisture content of 19 percent.

C. Fire Retardant Treatment, Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated, with maximum flame spread index of 25 when tested in accordance with ASTM E84; kiln dried after treatment to maximum moisture content of 19 percent.

1. Manufacturers:

a. Koppers, Inc; [_____]: http://www.koppersperformancechemicals.com/#sle.

b. Substitutions: See Section 01 6000 - Product Requirements.

D. Wood Preservative (Pressure Treatment): AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative to 0.25 lb/cu ft retention (to 4.0 kg/cu m retention); kiln dried after treatment to maximum moisture content of 19 percent.

E. Wood Preservative (Surface Application):

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that supports and openings are ready to receive trusses.

C. Verify sufficient bearing surface area.

3.02 ERECTION

A. Install trusses in accordance with manufacturer's instructions.

B. Install trusses level and plumb, in correct position.

C. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure plumb, and in true alignment until completion of erection and installation of permanent bracing.

D. Do not field cut or alter structural members without approval of Architect .

E. Install permanent bridging, bracing, and anchors.

F. Install headers and supports to frame openings required.

G. Frame openings between trusses with lumber in accordance with Section 06 1000.

H. Coordinate installation of decking.

I. After erection, touch up primed surfaces with primer consistent with shop coat.

3.03 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment in accordance with manufacturer's instructions.

B. Brush apply one coat of preservative treatment on wood in contact with cementitious materials and roofing and related metal flashings. Treat site-sawn cuts.

C. Allow preservative to dry prior to erecting members.

3.04 TOLERANCES

A. Framing Members: 1/4 inch (6 mm) maximum from true position.

B. Maximum Gap in Tension Member Joints: 1/16 inch (1.5 mm).

C. Maximum Gap in Compression Member Joints: 1/32 inch (0.8 mm).

END OF SECTION

SECTION 06 1500
WOOD DECKING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Softwood lumber structural wood decking.

B. Plywood structural wood decking.

C. Glued laminated structural wood decking.

D. Composite wood decking.

E. Fire retardant treatment of wood.

F. Preservative treatment of wood.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 03 3000 - Cast-in-Place Concrete: Bearing support.

C. Section 04 2000 - Unit Masonry: Bearing support.

D. Section 06 1000 - Rough Carpentry: Bearing support.

E. Section 09 9113 - Exterior Painting: Field finishing.

F. Section 09 9300 - Staining and Transparent Finishing: Field finishing.

1.03 REFERENCE STANDARDS

A. AITC 109 - Standard for Preservative Treatment of Structural Glued Laminated Timber 2007.

B. AITC 110 - Standard Appearance Grades for Structural Glued Laminated Timber 2001.

C. AITC 111 - Recommended Practice for Protection of Structural Glued Laminated Timber During Transit, Storage and Erection 2005.

D. AITC 112 - Standard for Tongue-and-Groove Heavy Timber Roof Decking 1993 and errata.

E. AITC 113 - Standard for Dimensions of Structural Glued Laminated Timber 2010.

F. AITC A190.1 - American National Standard for Wood Products - Structural Glued Laminated Timber 2007.

G. ASTM D143 - Standard Test Methods for Small Clear Specimens of Timber 2014.

H. ASTM D198 - Standard Test Methods of Static Tests of Lumber in Structural Sizes 2015.

I. ASTM D1761 - Standard Test Methods for Mechanical Fasteners in Wood 2012.

J. ASTM D2559 - Standard Specification for Adhesives for Bonded Structural Wood Products for Use Under Exterior Exposure Conditions 2012a (Reapproved 2018).

K. ASTM D2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing 2010 (Reapproved 2017).

L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2018b.

M. AWPA U1 - Use Category System: User Specification for Treated Wood 2017.

N. NELMA (SGR) - Standard Grading Rules for Northeastern Lumber 2017.

O. NLGA (SGRNL) - Standard Grading Rules for Canadian Lumber 2017.

P. PS 1 - Structural Plywood 2009.

Q. PS 20 - American Softwood Lumber Standard 2015.

R. RIS (GR) - Standard Specifications for Grades of California Redwood Lumber 2000.

S. SPIB (GR) - Grading Rules 2014.

T. WCLIB (GR) - Standard Grading Rules for West Coast Lumber No. 17 2015.

U. WWPA G-5 - Western Lumber Grading Rules 2017.

V. UL (FRD) - Fire Resistance Directory Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide technical data on wood preservative materials.

C. Shop Drawings: Indicate deck framing system, loads and cambers, bearing details and framed openings.

1. Include the design engineer's seal and signature on each sheet of shop drawings.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in Maryland.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with at least three years of documented experience and certified by AITC.

C. Installer Qualifications: Company specializing in performing work of the type specified in this section, with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect glue laminated members in accordance with AITC 111 requirements for unwrapped material.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 PRODUCTS

2.01 WOOD MATERIALS

A. Wood fabricated from old growth timber is not permitted.

B. Provide sustainably harvested wood; see Section 01 6000 - Product Requirements for requirements.

C. Provide wood harvested within a 500 mile (805 km) radius of the project site.

D. Lumber salvaged from deconstruction or demolition of existing buildings or structures is permitted in lieu of sustainably harvested lumber provided it is clean, denailed, and free of paint and finish materials, and other contamination; identify source.

1. Where salvaged lumber is used for structural applications, provide lumber re-graded by an inspection service accredited by the American Lumber Standard Committee, Inc.

E. Wood fabricated from recovered timber (abandoned in transit) is permitted in lieu of sustainably harvested lumber, unless otherwise noted, provided it meets the specified requirements for new wood and is free of contamination; identify source.

F. Regulatory Requirements:

G. Plywood Decking: PS 1 veneer plywood; APA Rated Sheathing, Span Rating [____]; Exterior grade;1 A interior veneer appearance grade; sanded.

H. Glued Laminated Decking: Softwood lumber of any species fabricated to comply with AITC A190.1 and AITC 113, laminated with adhesive tested according to ASTM D2559 for wet service; beveled edges, single tongue.

1. Appearance: Fabricate to AITC 110 Industrial grade.
2. After end trimming, seal with penetrating sealer.

I. Composite Decking: Hardwood mixed with plastic and molded into standard lumber board sizes and accessory shapes; minimum plastic content of 40 percent.

1. Texture: Molded wood grain finish one side; smooth, matte finish on the other.
2. Color: Select from manufacturer's standard colors.
3. Edges, Field Boards: Tongue and groove.
4. Edges, Perimeter Boards: Tongue and groove one edge; bullnose on the other.
5. Recycled content: 80 percent.
6. Surface Burning Characteristics: Flame spread index of 80, maximum; smoke developed index of 200, maximum; when tested in accordance with ASTM E84.
7. Resistance to Fastener Withdrawal When Tested in Accordance With ASTM D1761:
    a. Nail (8d common wire): 163 pounds per inch (28.5 kN/m).
    b. Screw (#10 wood screw): 558 pounds per inch (97.7 kN/m).
8. Compressive Strength Parallel to Length When Tested in Accordance with ASTM D198:
    a. Design: 550 pounds per square inch (3.79 MPa).
    b. Ultimate: 1806 pounds per square inch (12.45 MPa).
9. Compressive Strength Perpendicular to Length When Tested in Accordance with ASTM D143:
    a. Design: 625 pounds per square inch (4.31 MPa).
    b. Ultimate: 1994 pounds per square inch (13.75 MPa).
10. Tensile Strength When Tested in Accordance With ASTM D198:
    a. Design: 250 pounds per square inch (1.72 MPa).
    b. Ultimate: 854 pounds per square inch (5.4 MPa).
11. Shear Strength When Tested in Accordance With ASTM D143:
    a. Design: 200 pounds per square inch (1.37 MPa).
    b. Ultimate: 561 pounds per square inch (3.87 MPa).

2.02 ACCESSORIES

A. Fasteners and Anchors:

1. Fastener Type and Finish for Composite Decking: Stainless steel, trim head.
2. Screws: Bugle head, hardened steel, power driven type, length three times thickness of decking.
3. Anchors: Toggle bolt type for anchorage to hollow masonry.

2.03 WOOD TREATMENT

A. Factory-Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.

B. Fire Retardant Treatment:

1. Exterior Type: AWPA U1, Use Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; with maximum flame spread index of 25 when tested in accordance with ASTM E84 and with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.
    a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
2. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; maximum flame spread index of 25 when tested in accordance with ASTM E84 and with no evidence of significant combustion when test is extended for an additional 20 minutes.
    a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
    b. Do not use Type A treated wood in applications exposed to weather or where the wood may become wet.
3. Marking: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that support framing is ready to receive decking.

3.02 PREPARATION

A. Coordinate placement of bearing items.

3.03 INSTALLATION - PLYWOOD DECKING

A. Install decking perpendicular to framing members with ends staggered over firm bearing. On sloped surfaces, lay decking with tongue upward.

B. Engage plywood tongue and groove edges.

C. Allow expansion space at edges and ends.

D. Use sheathing clips at unsupported edges of plywood between supporting framing members.

E. Cut decking to accommodate roof drain and flange.

3.04 INSTALLATION - BOARD DECKING

A. Install decking perpendicular to framing members, with ends staggered over firm bearing. On sloped surfaces, lay decking with tongue upward.

B. Fit butt end deck joints occurring between support members with metal splines to maintain tight, aligned joints.

C. Engage decking tongue and groove edges.

D. Secure with fasteners. Side spike planks together, through pre-drilled holes.

E. Maintain decking joint space of 1/16 inch (1.5 mm) maximum.

F. Cut decking to accommodate roof drain and flange.

3.05 TOLERANCES

A. Surface Flatness of Decking Without Load: 1/4 inch in 10 feet (2 mm/m) maximum, and 1/2 inch in 30 feet (12 mm / 9 m) maximum.

END OF SECTION

SECTION 06 1736
METAL-WEB WOOD JOISTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Joists for roof and floor framing.

B. Bridging, bracing, and anchorage.

C. Framing for openings.

D. Fire retardant treatment of wood.

E. Preservative treatment of wood.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 06 1000 - Rough Carpentry: Installation requirements for miscellaneous framing.

C. Section 06 1000 - Rough Carpentry: Material requirements for blocking, bridging, plates, and miscellaneous framing.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2018b.

B. AWPA U1 - Use Category System: User Specification for Treated Wood 2017.

C. SPIB (GR) - Grading Rules 2014.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide joist configurations, bearing and anchor details, bridging and bracing .

C. Shop Drawings: Indicate framing system, sizes and spacing of joists, loads and joist cambers, required openings for web penetrations, framed openings . Submit design calculations.

1. Include the design engineer's seal and signature on each sheet of shop drawings.

D. Designer's Qualification Statement.

E. Manufacturer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design joists under direct supervision of a Professional Structural Engineer experienced in design of this product type and licensed in Maryland.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect joists from warping or other distortion by stacking in vertical position, braced to resist movement.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Comply with applicable codes for loading, seismic zoning, fire retardant criteria, and other governing load criteria.

2.02 MATERIALS

A. Lumber:

1. Moisture Content: Between 7 and 9 percent.
2. Lumber fabricated from old growth timber is not permitted.
3. Provide sustainably harvested lumber, certified or labeled as specified in Section 01 6000.
4. Provide lumber harvested within a 500 mile (805 km) radius of the project site.

B. Wood Chord Members: Single top and bottom chord, Stress Group [____], 19 percent maximum moisture content. Finger scarfing permitted.

C. Connecting Pins: Electrogalvanized structural carbon steel.

D. Joist Bridging: Type, size and spacing recommended by joist manufacturer.

2.03 FABRICATION

A. Fabricate joists to achieve structural requirements indicated.

2.04 WOOD TREATMENT

A. Factory-Treated Lumber: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.

B. Fire Retardant Treatment, Exterior Type: AWPA U1, Use Category UCFB, Commodity Specification H, chemically treated and pressure impregnated, maximum flame spread index of 25 when tested in accordance with ASTM E84; kiln dried after treatment to maximum moisture content of 19 percent.

1. Marking: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.

C. Fire Retardant Treatment, Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated, maximum flame spread index of 25 when tested in accordance with ASTM E84; kiln dried after treatment to maximum moisture content of 19 percent.

D. Preservative Pressure Treatment of Lumber: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative to 0.25 lb/cu ft retention (to 4.0 kg/cu m retention).

1. Kiln dry after treatment to maximum moisture content of 19 percent.
2. Marking: Mark each piece with stamp of an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

2.05 ACCESSORIES

A. Wood Blocking, Bridging, Plates, and Miscellaneous Framing: Softwood lumber, any species, construction grade, maximum moisture content of 19 percent.

B. Fasteners: Electrogalvanized steel, type to suit application.

C. Bearing Plates: Electrogalvanized, unfinished steel.

D. Metal Primer: .

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that supports and openings are ready to receive joists.

B. Verify that field measurements are as indicated.

3.02 PREPARATION

A. Coordinate placement of bearing items.

3.03 ERECTION

A. Install joists in accordance with manufacturer's instructions.

B. Set members level and plumb, in correct position.

C. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure plumb and in true alignment until completion of erection and installation of permanent bracing.

D. Do not field cut or alter structural members without approval of Architect .

E. Install permanent bridging and bracing.

F. Install headers and supports to frame openings required.

G. Frame openings between joists with lumber in accordance with Section 06 1000.

H. Coordinate installation of sheathing/decking.

I. After erection, touch-up galvanized surfaces with primer consistent with shop coat.

3.04 TOLERANCES

A. Framing Members: 1/2 inch (12 mm) maximum, from true position.

3.05 SCHEDULES

A. Main Roof: 20 inch (500 mm) deep joists, 8 inch (200 mm) end bearing plates for masonry supporting wall.

B. Penthouse Roof: 14 inch (350 mm) deep joists, special chord reinforcement for mechanical duct placement through joist as indicated, 2-1/2 inch (69 mm) end bearing plates for steel supporting frame.

END OF SECTION

SECTION 06 1753
SHOP-FABRICATED WOOD TRUSSES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated wood trusses for roof framing.

B. Bridging, bracing, and anchorage.

C. Fire retardant treatment of wood.

D. Preservative treatment of wood.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 06 1000 - Rough Carpentry: Installation requirements for miscellaneous framing.

C. Section 06 1000 - Rough Carpentry: Material requirements for blocking, bridging, plates, and miscellaneous framing.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2017.

B. ASTM D2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing 2010 (Reapproved 2017).

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2018b.

D. AWPA U1 - Use Category System: User Specification for Treated Wood 2017.

E. RIS (GR) - Standard Specifications for Grades of California Redwood Lumber 2000.

F. SPIB (GR) - Grading Rules 2014.

G. TPI 1 - National Design Standard for Metal-Plate-Connected Wood Truss Construction 2014.

H. TPI BCSI 1 - Building Component Safety Information Booklet: The Guide to Good Practice for Handling, Installing & Bracing of Metal Plate Connected Wood Trusses 2015.

I. TPI DSB-89 - Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses 1989.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on plate connectors, bearing plates, and metal bracing components.

C. Shop Drawings: Show truss configurations, sizes, spacing, size and type of plate connectors, cambers, framed openings, bearing and anchor details, and bridging and bracing.

1. Include identification of engineering software used for design.

2. Provide shop drawings stamped or sealed by design engineer.

D. Designer's Qualification Statement.

E. Fabricator's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Perform design by or under direct supervision of a Professional Structural ten Engineer experienced in design of this Work and licensed in Maryland.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Handle and erect trusses in accordance with TPI BCSI 1.

B. Store trusses in vertical position resting on bearing ends.

C. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 PRODUCTS

2.01 TRUSSES

A. Wood Trusses: Designed and fabricated in accordance with TPI 1 and TPI DSB-89 to achieve structural requirements indicated.

2.02 MATERIALS

A. Lumber:

1. Moisture Content: Between 7 and 9 percent.
2. Lumber fabricated from old growth timber is not permitted.
3. Provide sustainably harvested lumber, certified or labeled as specified in Section 01 6000.
4. Provide lumber harvested within a 500 mile (535 km) radius of the project site.

B. Steel Connectors: Hot-dipped galvanized steel sheet, ASTM A653/A653M Structural Steel (SS) Grade 33/230, with G90/Z275 coating; die stamped with integral teeth; thickness as indicated.

C. Truss Bridging: Type, size and spacing recommended by truss manufacturer.

2.03 ACCESSORIES

A. Wood Blocking, Bridging, Plates, and Miscellaneous Framing: Softwood lumber, any species, construction grade, 19 percent maximum and 7 percent minimum moisture content.

B. Fasteners: Electrogalvanized steel, type to suit application.

C. Bearing Plates: Electrogalvanized steel.

2.04 WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.

B. Fire Retardant Treatment, Exterior Type: AWPA U1, Use Category UCFB, Commodity Specification H, chemically treated and pressure impregnated, maximum flame spread index of 25 when tested in accordance with ASTM E84 and with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898; kiln dried after treatment to maximum moisture content of 19 percent for lumber and 15 percent for plywood.

1. Marking: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.

C. Fire Retardant Treatment, Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated, maximum flame spread index of 25 when tested in accordance with ASTM E84 and with no evidence of significant combustion when test is extended for an additional 20 minutes; kiln dried after treatment to maximum moisture content of 19 percent for lumber and 15 percent for plywood.

1. Marking: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.

D. Preservative Pressure Treatment of Lumber: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative to 0.25 lb/cu ft retention (to 4.0 kg/cu m retention).

1. Kiln dry after treatment to maximum moisture content of 19 percent.

E. Preservative Pressure Treatment of Plywood: AWPA U1, Use Category UC3B using waterborne preservative to 0.25 lb/cu ft retention (to 4.0 kg/cu m retention).

1. Kiln dry plywood after treatment to maximum moisture content of 19 percent.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that supports and openings are ready to receive trusses.

3.02 PREPARATION

A. Coordinate placement of bearing items.

3.03 ERECTION

A. Install trusses in accordance with manufacturer's instructions and TPI DSB-89 and TPI BCSI 1; maintain a copy of each TPI document on site until installation is complete.

B. Set members level and plumb, in correct position.

C. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure plumb, and in true alignment until completion of erection and installation of permanent bracing.

D. Do not field cut or alter structural members without approval of Architect .

E. Install permanent bridging and bracing.

F. Install headers and supports to frame openings required.

G. Frame openings between trusses with lumber in accordance with Section 06 1000.

H. Coordinate placement of decking with work of this section.

3.04 TOLERANCES

A. Framing Members: 1/2 inch (12 mm) maximum, from true position.

END OF SECTION

SECTION 06 1800
GLUED-LAMINATED CONSTRUCTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glue laminated wood beams and purlins.

B. Preservative treatment of wood.

C. Fire retardant treatment of wood.

D. Steel hardware and attachment brackets.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 09 9113 - Exterior Painting: Field finishing.

C. Section 09 9123 - Interior Painting: Field finishing.

D. Section 09 9300 - Staining and Transparent Finishing: Field finishing.

1.03 PRICE AND PAYMENT PROCEDURES

A. See Section 01 2200 - Unit Prices, for additional unit price requirements.

B. Glue Laminated Structural Column Members: By the unit. Includes unit member shop finished, connectors and brackets, placed and anchored.

C. Connections: By the pound (kg). Includes fabrication, finishing, and installation.

1.04 REFERENCE STANDARDS

A. AITC A190.1 - American National Standard for Wood Products - Structural Glued Laminated Timber 2007.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

E. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts 2015.

F. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts (Metric) 2007 (Reapproved 2013).

G. ASTM D2559 - Standard Specification for Adhesives for Bonded Structural Wood Products for Use Under Exterior Exposure Conditions 2012a (Reapproved 2018).

H. ASTM D2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing 2010 (Reapproved 2017).

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2018b.

J. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions 2015a.

K. AWPA U1 - Use Category System: User Specification for Treated Wood 2017.

L. AWS D1.1/D1.1M - Structural Welding Code - Steel 2015, with Errata (2016).

M. RIS (GR) - Standard Specifications for Grades of California Redwood Lumber 2000.

N. UL (FRD) - Fire Resistance Directory Current Edition.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide technical data on wood preservative materials, application technique and resultant performance information.

C. Shop Drawings: Indicate framing system, sizes and spacing of members, loads and cambers, bearing and anchor details, bridging and bracing, framed openings.

D. Designer's Qualification Statement.

E. Manufacturer's Qualification Statement.

F. Erector's Qualification Statement.

1.06 QUALITY ASSURANCE

A. Manufacturer/Fabricator Qualifications: Company specializing in manufacture of glue laminated structural units with three years of documented experience, and certified by AITC in accordance with AITC A190.1.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect members to AITC requirements for not wrapped.

B. Leave individual wrapping in place until finishing occurs.

C. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Glued-Laminated Structural Units:

1. Substitutions: See Section 01 6000 - Product Requirements.

2.02 GLUED-LAMINATED UNITS

A. Glued-Laminated Units: Fabricate in accordance with AITC 117 Industrial grade.

1. Verify dimensions and site conditions prior to fabrication.
2. Cut and fit members accurately to length to achieve tight joint fit.
3. Fabricate member with camber built in.
4. Do not splice or join members in locations other than those indicated without permission.
5. Fabricate steel hardware and connections with joints neatly fitted, welded, and ground smooth.
6. Welding: Perform welding in accordance with AWS D1.1/D1.1M.
7. After end trimming, seal with penetrating sealer in accordance with AITC requirements.

B. Performance Criteria:

1. Comply with applicable code for loads, seismic zoning, and other load criteria.

C. Fire Rating: Comply with UL (FRD).

2.03 MATERIALS

A. Lumber: Softwood lumber complying with RIS (GR) grading rules with 12 percent maximum moisture content before fabrication. Design for the following values:

1. Provide sustainably harvested lumber, certified or labeled as specified in Section 01 6000.
2. Provide lumber harvested within a 500 mile (805 km) radius of the project site.

B. Steel Connections and Brackets: ASTM A36/A36M weldable quality, galvanize per ASTM A123/A123M.

C. Anchor Bolts: ASTM F3125/F3125M, Type 1 heavy hex high strength bolts and ASTM A563 (ASTM A563M) nuts; hot-dip galvanized to meet requirements of ASTM A153/A153M, matching washers.

D. Laminating Adhesive: Tested for wet/exterior service in accordance with ASTM D2559.

E. Wood Sealer:

F. Bearing Plate Anchors: Expansion shield and lag bolt type for anchorage to solid masonry or concrete.

G. Metal Primer:

2.04 WOOD TREATMENT

A. Factory-Treated Lumber: Comply with requirements of AWPA U1 - Use Category System for pressure impregnated wood treatments determined by use categories, expected service conditions, and specific applications.

B. Fire Retardant Treatment:

1. Exterior Type: AWPA U1 Use Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; maximum flame spread index of 25 when tested in accordance with ASTM E84 and with no evidence of significant combustion when test is extended for an additional 30 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.
    a. Kiln dry wood after treatment to a maximum moisture content of 19 percent prior to lamination.
2. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; maximum flame spread index of 25 when tested in accordance with ASTM E84 and with no evidence of significant combustion when test is extended for an additional 20 minutes.
    a. Kiln dry wood after treatment to a maximum moisture content of 19 percent prior to lamination.
    b. Do not use treated wood in applications exposed to weather or where the wood may become wet.
3. Marking: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.

C. Preservative Pressure Treatment:

1. Preservative Pressure Treatment of Glued-Laminated Structural Units: AWPA U1, Use Category UC3B, Commodity Specification F using waterborne preservative to 0.25 lb/cu ft retention (to 4.0 kg/cu m retention).
    a. Kiln dry lumber after treatment and before lamination to maximum moisture content of 19 percent.
2. Marking: Marked each piece with stamp of an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

D. Shop treat wood materials in accordance with manufacturer's instructions.

2.05 FABRICATION

A. Fabricate glue laminated structural members in accordance with AITC Industrial grade.

B. Welding: Perform welding in accordance with AWS D1.1/D1.1M.

C. Verify dimensions and site conditions prior to fabrication.

D. Cut and fit members accurately to length to achieve tight joint fit.

E. Fabricate member with camber built in.

F. Do not splice or join members in locations other than those indicated without permission.

G. Fabricate steel hardware and connections with joints neatly fitted, welded, and ground smooth.

H. After end trimming, seal with penetrating sealer in accordance with AITC requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that supports are ready to receive units.

B. Verify sufficient end bearing area.

3.02 PREPARATION

A. Coordinate placement of bearing items.

3.03 ERECTION

A. Lift members using protective straps to prevent visible damage.

B. Set structural members level and plumb, in correct positions or sloped where indicated.

C. Provide temporary bracing and anchorage to hold members in place until permanently secured.

D. Fit members together accurately without trimming, cutting, splicing, or other unauthorized modification.

E. Swab and seal the interior wood surfaces of field drilled holes in members with primer.

F. Field Finishing: Specified in Section 09 9113 and 09 9123.

3.04 TOLERANCES

A. Framing Members: 1/2 inch (12 mm) maximum from true position.

END OF SECTION

SECTION 06 2000
FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Finish carpentry items.

B. Wood door frames, glazed frames.

C. Wood casings and moldings.

D. Hardware and attachment accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.

C. Section 06 4100 - Architectural Wood Casework: Shop fabricated custom cabinet work.

D. Section 08 1416 - Flush Wood Doors.

E. Section 09 9113 - Exterior Painting: Painting of finish carpentry items.

F. Section 09 9123 - Interior Painting: Painting of finish carpentry items.

G. Section 09 9300 - Staining and Transparent Finishing: Staining and transparent finishing of finish carpentry items.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials current edition.

B. ANSI A135.4 - American National Standard for Basic Hardboard 2012.

C. ANSI A208.1 - American National Standard for Particleboard 2009.

D. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test 2015.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2018b.

F. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards 2014, with Errata (2016).

G. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1 2016, with Errata (2017).

H. AWPA U1 - Use Category System: User Specification for Treated Wood 2017.

I. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood 2016.

J. PS 1 - Structural Plywood 2009.

K. WDMA I.S. 4 - Industry Specification for Preservative Treatment for Millwork 2015a.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with plumbing rough-in, electrical rough-in and installation of associated and adjacent components.

B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data:

1. Provide data on fire retardant treatment materials and application instructions.

C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

1. Scale of Drawings: 1-1/2 inch to 1 foot (125 mm to 1 m), minimum.
2. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
3. Include certification program label.

D. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1. Company with at least one project within the past 5 years with value of woodwork within 20 percent of cost of woodwork for this project.
2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
3. Single Source Responsibility: Provide and install this work from single fabricator.

B. Quality Certification:

1. Provide labels or certificates indicating that the work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
2. Provide designated labels on shop drawings as required by certification program.
3. Provide designated labels on installed products as required by certification program.
4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect work from moisture damage.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Surface Burning Characteristics: Provide materials having fire and smoke properties as required by applicable code.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

B. Provide sustainably harvested wood, certified or labeled as specified in Section 01 6000 - Product Requirements.

C. Provide wood harvested within a 500 mile (805 km) radius of the project site.

D. Wood fabricated from timber recovered from riverbeds or otherwise abandoned is permitted, unless indicated otherwise, and provided it is clean and free of contamination, identify source; provide lumber re-graded by an inspection service accredited by the American Lumber Standard Committee, Inc. (ALSC).

2.03 SHEET MATERIALS

A. Softwood Plywood, Not Exposed to View: Any face species, medium density fiberboard core; PS 1 Grade A-B, glue type as recommended for application.

B. Softwood Plywood, Exposed to View: Face species as indicated, plain sawn, medium density fiberboard core; PS 1 Grade A-B, glue type as recommended for application.

C. Hardwood Plywood: Face species as indicated, plain sawn, book matched, medium density fiberboard core; HPVA HP-1 Front Face Grade AA, Back Face Grade 1, glue type as recommended for application.

D. Particleboard: ANSI A208.1 Composed of wood chips, sawdust, or flakes of medium density, made with waterproof resin binders; of grade to suit application; sanded faces.

E. Hardboard: ANSI A135.4 Pressed wood fiber with resin binder, Class 1 - Tempered, 1/4 inch (6 mm) thick, smooth one side (S1S).

F. Pegboard: Pressed wood fiber with resin binder, standard grade; 1/8 inch (3 mm) thick, with holes spaced at 1 inch (25.4 mm) on center in both directions.

2.04 PLASTIC LAMINATE MATERIALS

2.05 FASTENINGS

A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.

B. Concealed Joint Fasteners: Threaded steel.

2.06 ACCESSORIES

A. Cellular PVC Trim and Mouldings: Extruded, expanded PVC; UV-resistant, heat-stabilized, and rigid material.

B. Aluminum Edge Trim: Extruded convex shape; smooth surface finish; self locking serrated tongue; of width to match component thickness; natural mill finish.

C. Safety Glass: Laminated glass complying with 16 CFR 1201 and ANSI Z97.1; clear; nominally 6 mm thick.

D. Primer: Alkyd primer sealer.

E. Wood Filler: Solvent base, tinted to match surface finish color.

2.07 WOOD TREATMENT

A. Factory-Treated Lumber: Comply with requirements of AWPA U1 - Use Category System for pressure impregnated wood treatments determined by use categories, expected service conditions, and specific applications.

B. Fire Retardant Treatment (FR-S Type): Chemically treated and pressure impregnated; capable of providing flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.

C. Wood Preservative by Pressure Treatment (PT Type): Provide AWPA U1 treatment using waterborne preservative with 0.25 percent retainage.

D. Water Repellent Preservative Treatment by Dipping Method: WDMA I.S. 4, with 0.25 percent retainage.

E. Wood Preservative (Surface Application): Colored.

F. Shop pressure treat wood materials requiring fire rating to concealed wood blocking.

G. Provide identification on fire retardant treated material.

H. Redry wood after pressure treatment to maximum percent moisture content as allowed by manufacturer.

2.08 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. Shop prepare and identify components for book match grain matching during site erection.

C. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

D. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs. (Locate counter butt joints minimum 600 mm from sink cut-outs.)

2.09 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. Apply wood filler in exposed nail and screw indentations.

C. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.

D. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:

E. Back prime woodwork items to be field finished, prior to installation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.02 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Set and secure materials and components in place, plumb and level.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim to conceal larger gaps.

3.03 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment in accordance with manufacturer's instructions.

B. Brush apply one coats of preservative treatment on wood in contact with cementitious materials. Treat site-sawn cuts.

C. Allow preservative to dry prior to erecting members.

3.04 PREPARATION FOR SITE FINISHING

A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

B. Site Finishing: See Section 09 9113 and 09 9123.

C. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

3.05 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch (1.6 mm).

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch (0.79 mm).

END OF SECTION

SECTION 06 4100
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specially fabricated cabinet units.

B. Hardware.

C. Factory finishing.

D. Preparation for installing utilities.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.

C. Section 06 6100 - Cast Polymer Fabrications: Cast plastic countertops.

D. Section 08 8000 - Glazing: Glass for casework.

E. Section 09 9123 - Interior Painting: Field finishing of cabinet exterior.

F. Section 09 9300 - Staining and Transparent Finishing: Field finishing of cabinet exterior.

G. Section 12 3600 - Countertops.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards 2014, with Errata (2016).

B. AWI (QCP) - Quality Certification Program current edition at www.awiqcp.org.

C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1 2016, with Errata (2017).

D. BHMA A156.9 - American National Standard for Cabinet Hardware 2015.

E. NEMA LD 3 - High-Pressure Decorative Laminates 2005.

F. UL (DIR) - Online Certifications Directory Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

1. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).

2. Include certification program label.

C. Product Data: Provide data for hardware accessories.

D. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches (300 mm) square, illustrating proposed cabinet, countertop and shelf unit substrate and finish.

E. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards and locksets, demonstrating hardware design, quality, and finish.

F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

G. Sustainable Design Submittal: Documentation for sustainably harvested wood-based components.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.

B. Quality Certification:

1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.

2. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.

3. Provide designated labels on shop drawings as required by certification program.

4. Provide designated labels on installed products as required by certification program.

5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

6. Replace, repair, or rework all work for which certification is refused.

1.07 MOCK-UP

A. Provide mock-up of typical base cabinet, wall cabinet and countertop, including hardware, finishes and plumbing accessories.

B. See Section 01 4000 - Quality Requirements for additional requirements.

C. Locate where directed.

D. Mock-up may remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.09 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 CABINETS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

B. Provide sustainably harvested wood, certified or labeled as specified in Section 01 6000.

C. Wood fabricated from timber recovered from riverbeds or otherwise abandoned is permitted, unless otherwise noted, provided it is clean and free of contamination; identify source; provide lumber re-graded by an inspection service accredited by the American Lumber Standard Committee, Inc.

D. Hardwood Edgebanding: Use solid hardwood edgebanding matching species, color, grain, and grade for exposed portions of cabinetry.

2.03 LAMINATE MATERIALS

A. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.

2.04 COUNTERTOPS

A. Countertops are specified in Section 12 3600.

2.05 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

B. Plastic Edge Banding: Extruded PVC, convex shaped; smooth finish; self locking serrated tongue; of width to match component thickness.

1. Color: As indicated on drawings.

C. Aluminum Edge Banding: Extruded convex shape; smooth surface finish; self locking serrated tongue; of width to match component thickness; natural mill finish.

D. Vinyl Countertop Edge: PVC anchor type tee-molding edging in width to match thickness of countertop, color as indicated, used at locations as indicated.

E. Glass: Type A as specified in Section 08 8000.

F. Fasteners: Size and type to suit application.

G. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.

H. Concealed Joint Fasteners: Threaded steel.

I. Grommets: Standard plastic, painted metal or rubber grommets for cut-outs, in color to match adjacent surface.

2.06 HARDWARE

A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.

B. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch (25 mm) spacing adjustments.

2.07 SHOP TREATMENT OF WOOD MATERIALS

A. Provide UL (DIR) listed and approved identification on fire retardant treated material.

B. Deliver fire retardant treated materials cut to required sizes. Minimize field cutting.

2.08 SITE FINISHING MATERIALS

A. Finishing: Field finished as specified in Section 09 9300.

2.09 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs. (Locate counter butt joints minimum 600 mm from sink cut-outs.)

1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
2. Cap exposed plastic laminate finish edges with material of same finish and pattern.

E. Matching Wood Grain: Comply with requirements of quality standard for specified Grade and as follows:

1. Provide center matched panels at each elevation.
2. Provide sequence matching across each elevation.
3. Carry figure of cabinet fronts to toe kicks.

F. Mechanically fasten back splash to countertops as recommended by laminate manufacturer at 16 inches (400 mm) on center.

G. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

H. Shop glaze glass materials using the Interior Dry method as specified in Section 08 8000.

2.10 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. For opaque finishes, apply wood filler in exposed nail and screw indentations and sand smooth.

C. On items to receive transparent finishes, use wood filler matching or blending with surrounding surfaces and of types recommended for applied finishes.

D. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

C. Use fixture attachments in concealed locations for wall mounted components.

D. Use concealed joint fasteners to align and secure adjoining cabinet units.

E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim for this purpose.

F. Secure cabinets to floor using appropriate angles and anchorages.

G. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.03 ADJUSTING

A. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION